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EDISON ELECTRIC INSTITUTE BULLETIN

Electric Power Systems and Nuclear Power
WALKER L. CISLER 289

The Planningest People . . . . . GWILYM A. PRICE 294

Planning Kilovar Supply . . . . . C. H. HOFFMAN 295

Sleeve or Ball Bearings for Generating-Station Motors . . . 303

Economic Practicability of Railroad Electrification Studied in New Report. 305

An Operating Function of No Concern to Public Power Projects
ANN F. LORD 307

EEI Resuscitation Cases Demonstrate Effectiveness of Life-Saving Techniques 309

Personals 318

Conventions and Meetings 320

PUBLISHED MONTHLY BY EDISON ELECTRIC INSTITUTE

ELECTRICAL RESEARCH STATISTICS
THE ELECTRIC LIGHT AND POWER INDUSTRY

Current Statistical Data Covering 100 Per Cent of Industry

May, 1951-1952

SOURCE AND DISPOSAL OF ENERGY—MONTH OF MAY

	1952	1951	%
GENERATION* (Net)			
By Fuel Burning Plants	22,132,019,000	21,334,453,000	+ 3.7
By Water Power Plants	9,692,472,000	8,536,611,000	+13.5
Total Generation	**31,824,491,000**	**29,871,064,000**	**+ 6.5**
Add—Net Imports Over International Boundaries	212,391,000	177,610,000	+19.6
Less—Company Use	106,150,000	109,524,000	− 3.2
Less—Energy Used by Producer	804,700,000	644,476,000	+24.9
Net Energy for Distribution	**31,126,032,000**	**29,294,674,000**	**+ 6.3**
Lost and Unaccounted for	3,948,107,000	3,827,983,000	+ 3.1
Sales to Ultimate Customers	**27,177,925,000**	**25,466,691,000**	**+ 6.7**

CLASSIFICATION OF SALES

NUMBER OF CUSTOMERS—As of May 31			
Residential or Domestic	39,762,636	38,205,843	+ 4.1
Rural (Distinct Rural Rates)	1,682,168	1,627,663	+ 3.3
Commercial or Industrial:			
Small Light and Power	5,561,539	5,479,085	+ 1.5
Large Light and Power	259,256	239,474	+ 8.3
Other Customers	164,720	159,262	+ 3.4
Total Ultimate Customers	**47,430,319**	**45,711,327**	**+ 3.8**
KILOWATTHOUR SALES—During Month of May			
Residential or Domestic	6,679,207,000	5,949,974,000	+12.3
Rural (Distinct Rural Rates)	638,992,000	707,355,000	− 9.7
Commercial or Industrial:			
Small Light and Power	4,767,040,000	4,482,311,000	+ 6.4
Large Light and Power	13,668,986,000	12,937,238,000	+ 5.7
Street and Highway Lighting	249,470,000	230,626,000	+ 8.2
Other Public Authorities	690,615,000	647,787,000	+ 6.6
Railways and Railroads:			
Street and Interurban Railways	252,975,000	273,532,000	− 7.5
Electrified Steam Railroads	190,569,000	191,149,000	− 0.3
Interdepartmental	40,071,000	46,719,000	−14.2
Total to Ultimate Customers	**27,177,925,000**	**25,466,691,000**	**+ 6.7**
Revenue from Ultimate Customers	**$486,460,100**	**$451,675,900**	**+ 7.7**

RESIDENTIAL OR DOMESTIC SERVICE

AVERAGE CUSTOMER DATA—For 12 months ended May 31			
Kilowatthours per Customer	2,078	1,909	+ 8.9
Average Annual Bill	$57.85	$54.41	+ 6.3
Revenue per Kilowatthour	2.78¢	2.85¢	− 2.5

* By Courtesy of the Federal Power Commission.

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EDISON ELECTRIC INSTITUTE BULLETIN

Volume 20 SEPTEMBER, 1952 No. 9

Electric Power Systems and Nuclear Power

Walker L. Cisler

President, The Detroit Edison Company

An address before the Fifth Annual Summer Institute, University of Michigan Law School, Ann Arbor, Mich., June 26, 1952

IT was my privilege, first in 1947, to have a small part in the activities of the Atomic Energy Commission in formulating controls over the export of materials and equipment peculiar to the atomic process. Thus, I had a very close view of the efforts that were being put forth by the AEC to broaden and strengthen the scope of industry's participation in atomic energy development. Through the years since 1947, I have seen those efforts intensified, and the fact that peacetime uses of atomic energy are being discussed today is proof of the effectiveness and wisdom of those efforts which had their beginning five years ago.

Private capital has a great interest in the development of nuclear power because of the tremendous possibilities it holds. Nuclear-power development is a challenge, I believe, not only from the standpoint of our free-enterprise system, but also from the standpoint of what it may enable private industry to do in furthering the security of this country. The security aspect is extremely important.

Development by Private Capital

The opportunities of private capital to develop uses of atomic energy may be considered under two main parts: first, the utilization of atomic fission as a source of heat energy and, second, the sale of products which result from nuclear fission. In addition, of course, there is the real possibility of an increased supply of weapons materials.

It is very likely that the investment of private capital and the enterprise which must go into the development of atomic energy in industry will largely follow the patterns of the past. These patterns have been apparent in the industrial development of this country. We have all seen how important private enterprise and investment capital are. It is through them that this country has attained the highest standard of living in the world.

There are many aspects of atomic-energy development—technical and economic—which have tremendous implications. And there are other aspects—social and political—which are of equally profound significance, both from a national and an international standpoint. The Atomic Energy Act of 1946 placed responsibility for all these aspects in one centralized agency of our government. This was perhaps as great a responsibility as has ever been given to any agency of any government. And out of that has come a tremendous undertaking, largely concerned with defense.

Up to the present time, atomic energy has not contributed greatly to raising the standard of living in this country. Although there have been many helpful developments in the field of medical, agricultural, and other research, atomic energy will not assume its proper place in industry until the utilization of nuclear heat becomes practical.

I sometimes feel that we might liken what has occurred to a thermodynamic process where, in one instance, there is an endothermic reaction and in the other instance the reaction is exothermic. At present, atomic energy activities are consuming the country's resources rather than contributing to them because of the large amounts of electricity, manpower, and materials required in the processes. This is what I mean by an endothermic reaction. If atomic energy is to take a sound economic place in the world, this situation must be reversed. It is our job to make this process exothermic, to see to it that atomic energy contributes rather than subtracts from the resources of the nation and the world.

One type of nuclear reactor is a producer of heat during the process which we hope can be turned into the production of electric power and also put to other uses in industry. For example, installations at Hanford and the one under construction on the Savannah River in South Carolina are installations which produce heat energy as a part of the process.

Heat-Consuming Plants

Another type of equipment which produces fissionable materials, for example, the installations at Oak Ridge, consumes great quantities of electric power and, therefore, great quantities of heat energy and fuel. The plants under construction at Paducah and the additional plants which now figure in the request for Congressional appropriations also are of this kind.

Private capital in all probability would not be interested in plants which consume great quantities of electric power, except possibly as operators of AEC-owned facilities. It would be interested in plants producing heat, that would be useful in the production of electric power. It is important, therefore, that we bring into focus these various considerations in discussing the invest-

ment of private capital in the development of industrial uses for atomic energy.

What is the specific interest of electric-power systems in nuclear power? Fundamentally, of course, the electric-power systems of the country have the responsibility of furnishing the best possible power service at the lowest practical cost to their customers. They are well aware of this responsibility and do not take it lightly. They have always been alert to new developments which will bring better service and greater economy. Those responsible for the management of the country's power systems fully recognize that atomic energy may bring substantial advancement in the matter of power supply.

Perhaps we can explain the interest of the electric-power systems more clearly by discussing the joint project of The Dow Chemical Co. and The Detroit Edison Co. for studying the feasibility of utilizing the heat from nuclear fission. It is interesting to note that both of these companies are large users of fuel. Detroit Edison, for example, in 1951 purchased some 4.5 million tons of coal at a cost of more than $35 million. The Dow Chemical Co. purchased some 800,000 tons during that year for operations at Midland, Mich.

	Generating Capacity — Millions of Kilowatts			Generation — Billions of Kilowatthours			FUEL			
	Thermal	Hydro	Total	Thermal	Hydro	Total	Millions of Tons	Millions of Bbls	Trillions of Cu Ft	Coal Equivalent Million Tons
1931	24.6	9.1	33.7	58.4	29.0	87.4	36.1	7.9	138.4	43.9
1951	56.9	18.9	75.8	271.0	99.7	370.7	105.7	63.5	763.1	159.0
1955	88.0	25.3	113.0	410.0	120.0	530.0	152.0			222.0
1960	117.0	27.0	164.0	550.0	137.0	687.0	202.0			278.0
1965	144.0	31.0	175.0	690.0	154.0	844.0	251.0			334.0
1970	171.0	34.0	205.0	830.0	170.0	1000.0	300.0			390.0

Note - 1931 EEI Statistical Bulletin

1951 and 1955 Generation from EEI Eleventh Semi-Annual Electric Power Survey
Generating Capacity and Coal Estimated

1960, 1965 and 1970 Estimated Based on statement of Chester Lang, Vice President, General Electric Company, that power consumption will exceed one trillion kilowatthours in 1970

Coal Equivalent for 1970 averages 0.94 lb per kwhr

Fig. 1—Fuel Consumption for Electric Power Generation, U. S. Electric Power Systems.

Fuel Requirements

Before discussing details of the Dow-Edison project and bringing into focus some of the financial aspects with which an electric-power system is concerned when it looks at atomic energy, let us examine Fig. 1. This chart shows the total fuel requirements of the electric-power systems of the United States. Up to the present, the electric-power systems in this country have been dependent upon the use of the conventional gaseous, liquid, and solid fuels for thermal generation. During 1931, the equivalent of almost 44 million tons of coal were used for power generation. At that time, the total generating capability of the interconnected systems of the country was about 33.7 million kw.

By 1951, our nation's capability had been increased to 75.8 million kw, and the amount of fuel required for power generation amounted to the equivalent of 159 million tons of coal. This included 105.7 million tons of solid fuels, about 63.5 million barrels of oil, and some 763.1 trillion cubic feet of gas. And, because the electric industry is expanding very rapidly, fuel requirements will increase greatly in the years ahead.

I would like to comment briefly on the significance of our electric-power capacity. If we add to the 75.8 million kw of the interconnected systems the 15 million kw of generating capability in our industrial plants, this country now has nearly 91 million kw of generating capability. Thus, here in the United States today we have almost 42 per cent of the electric power of the world.

That capacity is vitally important to us, not only to our civilian economy but also to our national defense. It is important to realize also that 75 per cent of this total capability is in the form of thermal-electric generation and about 25 per cent is in the form of hydroelectric generation. These kilowatts of generating capability are being increased daily through a construction program which will add more than 30 million kw of new generating capability in the next few years. In fact, it is possible that by the end of 1955 as much as 38 million kw of generating capability will have been added. The major part of the new generating capacity will be in the form of thermal-electric generation and will make use of the conventional fuels.

It is interesting to note, too, that the amount of capital—and we are talking about private capital—invested in these interconnected power systems today totals about $21 billion. By the end of 1954, the investment will be up to $28 billion, an increase of about $7 billion. This gives some idea of the great amounts of private capital that are going into the expansion of the electric-power systems of this country.

It is well for us to realize that 80 per cent of the total generating facilities of the country which contribute to the public supply are private, investment-owned systems like The Detroit Edison Co. and the Consumers Power Co. in Michigan. About 11 per cent of the facilities are in the systems of the Federal government, such as TVA, and about 9 per cent are in the systems of publicly-owned, non-federal agencies similar to the municipal system at Lansing, Mich. The electric-power business of this country depends predominantly on private capital, and there is every indication that the proportion of electrical load supplied by private systems will continue at about the present level as ever-increasing requirements are met.

Now let us look ahead—five, ten, 15, and 20 years. Fig. 1 shows that by 1955 generating capability will have increased to 113 million kw and the equivalent coal requirements should be approximately 222 million tons. Looking still farther ahead to 1965, we expect to have 175 million kw of generating capability, which will require the equivalent of some 334 million tons of coal. By 1970—and we are now looking ahead less than 20 years—the annual fuel requirements for power generation may be the equivalent of 390 million tons of coal.

In carrying out the Dow-Edison project, we have had the valuable advice of my good friend, Dr. Robert McMath, Director of the University of Michigan's McMath-Hulburt Observatory at Lake Angelus, Mich., and

also a Director of The Detroit Edison Co. Among other things, he explained to me that the heat released from the sun is really radiant energy, which is the result of the conversion of matter into energy, that the sun converts about two million tons of matter into energy each second of time, and that from this great amount the earth receives an equivalent of about four pounds per second, a part of which is reflected back into space.

All of the plant and animal life of this planet is dependent upon that small part of the radiant energy of the sun intercepted by the earth. The very extensive deposits of fuel on this earth are also the result of the storing up of a fraction of the sun's radiation to this planet.

While the sun is remote and the reactions there obviously are not directly related to our efforts here on earth, the processes involved are identical, and the solar reaction is a most startling example of the potentialities of heat involved in nuclear fission. This has given us added confidence in proceeding with the project.

According to the best knowledge now available, it is believed that the heat released by nuclear fission in a reactor can be captured and used to produce steam, which will then be utilized to generate electric power. The most desirable methods for releasing the heat and converting it to useful purposes are still matters of research. The cost of a reactor that will operate most advantageously cannot yet be determined accurately.

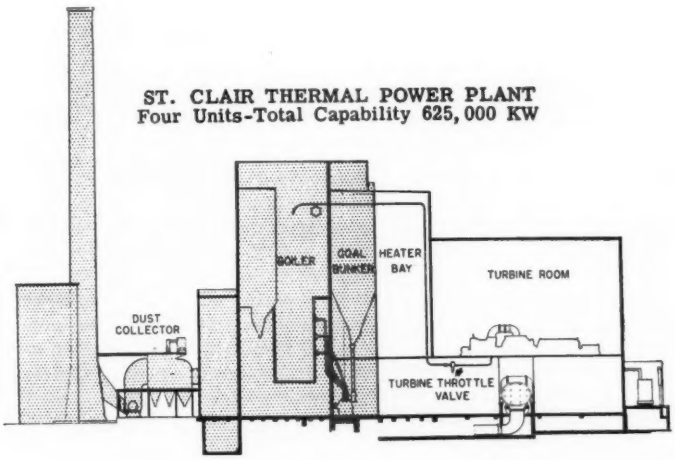
The economic problem which really is before the electric-power systems may be stated briefly as follows: how can heat energy from a nuclear reactor be delivered to the point of utilization at a cost equal to, or less than, heat energy from the conventional gaseous, liquid, or solid fuels now used? That really is the crux of the matter. In other words, the problem is how can a nuclear reactor be developed which will deliver energy, whether from one kind of atomic fuel or another, at a cost competitive with the normal sources of heat energy.

Also—and this is important—in comparing the costs of energy, we must include hydraulic energy, because here we are really comparing the costs of all sources of energy for electric-power generation. A kilowatt of capacity or a kilowatthour of energy does not recognize the source of the energy behind it. There is the same quantity of heat or the same quantity of electricity in each of those units, whether the generation results from the use of conventional fuel, hydraulic energy, or atomic energy.

It seemed to us that one of the best ways to approach the Dow-Edison study was to look at the usual thermal-electric generating station and consider it as two components, one having to do with the production and delivery of heat units from fuel and the other having to do with the electric generation. The shaded area in Fig. 2 represents that part of a normal electric-generating station concerned with the production of heat energy. Note where the turbine throttle is indicated in the figure. This is very important, because it is at the turbine throttle that introduction of heat energy into the turbine for the electric generation occurs.

To illustrate this, let us look at the St. Clair thermal power plant of The Detroit Edison Co., now under construction on the St. Clair River. This new plant will have four generating units with a total capability of 625,000 kw. Included in the shaded area are the coal- and ash-handling equipment, the boilers, flue dust collectors, and smokestacks—all of the facilities needed to burn coal and deliver steam to the turbine throttle valve. The unshaded portion of the plant includes the equipment and facilities needed to convert the steam received at the turbine throttle valve into electrical energy. These are the turbine generator, condenser, pumps, and numerous other equipment.

Estimates presented in Fig. 2 show the cost of the steam generation facilities as $49 million, or $77 per kilowatt of capability. For electric generation, the cost is $51 million or $81 per kilowatt.



	Steam Generation	Electric Generation	Total Plant
Total Cost	$ 48,293,000	$ 50,407,000	$ 98,700,000
Cost per Kw Capability	$ 77.00	$ 81.00	$ 158.00
% of Total Plant	49	51	100
% of Total Company Investment	17*	18*	35*

*These percentages represent the sum of the investments in steam generation facilities, electric generation facilities and power plants respectively, in the four power plants of The Detroit Edison Company, as of June 30, 1951. The new St. Clair Plant is not included.

Fig. 2—Cross-Section of Typical Thermal Electric Power Plant. Shaded Area Might Be Replaced by Nuclear Heat Power Reactor.

Substitution of Nuclear Reactor

These items are of particular significance. Present developments show that it may be possible to substitute a nuclear reactor for the steam generation part of a modern thermal-electric generating station. The part of the station that might be eliminated represents a little less than one-half of the station's total cost. The part of the station used entirely for electric generation, costing just over one-half of the total for the station, must remain, whether the heat source is from conventional fuels or from a nuclear reactor.

It is extremely important in discussing this part of the problem to bear in mind two other items shown in Fig. 2. They are the percentages of total system investment represented by each of the components of this typical thermal-electric generating station. Based upon data of a year ago, the investment in steam generating facilities of Detroit Edison's four main thermal power plants amounted to 17 per cent of the company's total investment. The investment in the associated electric-generating facilities amounted to 18 per cent of the total company investment.

These values, 17 and 18 per cent, may vary somewhat among different electric-power systems. On the whole, however, they are typical for any predominantly thermal system. Since it is contemplated that nuclear reactors may be substituted only for the steam generation facilities—accounting for 17 per cent of the total system investment—it is obvious that only this comparatively small part of the total system's costs can be influenced by the substitution. I believe that fact has not been as widely understood as it should be, and I hope that through this discussion there will be a clearer realization of the fact that atomic energy, as now foreseen, will affect only a small part of our present operations and investments.

Amount of Investment

We shall now undertake to determine the amount of investment we might be justified in making in a nuclear heat-power reactor that would bring heat energy to the turbine throttle at a cost no greater than the cost to heat from a conventional heat source. There are two columns in Fig. 3. The one on the left shows the estimated annual operating costs of supplying heat to the turbine throttle for the conventional plant. The one on the right shows the limit of the investment that could be justified in a reactor, assuming no labor, maintenance, or fuel costs.

For the shaded part of the generating station shown in Fig. 2, the operating manpower expense is about $180,000 a year, while the operation and maintenance materials and supplies expense is about $307,000.

The annual fixed charges on the thermal part of the plant—the part concerned with delivering the heat units up to the turbine throttle—calculated at 10 per cent of the investment, amount to $4,829,300. The fuel costs for that plant will be $8,855,000 (1,232,000 tons of coal at $7.18 a ton). The total annual operating expense of the conventional plant is $14,171,300, and the cost of delivering the heat units to the turbine throttle figures out to be 57.7 cents per million Btu.

It would be well to remember the latter figures, because I think it will help us greatly in keeping in focus just what it is that we are endeavoring to do. This 57.7 cents is the cost of one million Btu of heat energy delivered to the turbine throttle. The turbine throttle doesn't care where that heat energy comes from so long as the proper steam conditions are maintained. It can come from gas; it can come from oil or coal; or it can come from fission of atomic fuel.

In the right hand column, the annual operating costs are shown capitalized at 10 per cent. If it is assumed that the nuclear reactor has no operating-labor expense, we can afford to invest $1,800,000 for that item alone. For operation and maintenance supplies and materials, we can afford to invest $3,070,000. The annual fixed charges on the investment in the thermal-generation facilities, capitalized at 10 per cent, are $48,293,000. If it is possible to get the equivalent heat units of the coal from the nuclear reactor at no fuel expense, what is normally paid for fuel can be capitalized at $88,550,000. The total of those amounts is $141,713,000, the amount which might justifiably be invested in a nuclear heat-power reactor, which, at no fuel cost and no operating-labor or maintenance expense, would deliver one million Btu of heat energy at a cost of 57.7 cents. We would thus be justified in investing not more than $227 per kilowatt for a reactor and accompanying equipment capable of supplying steam to generate electric power.

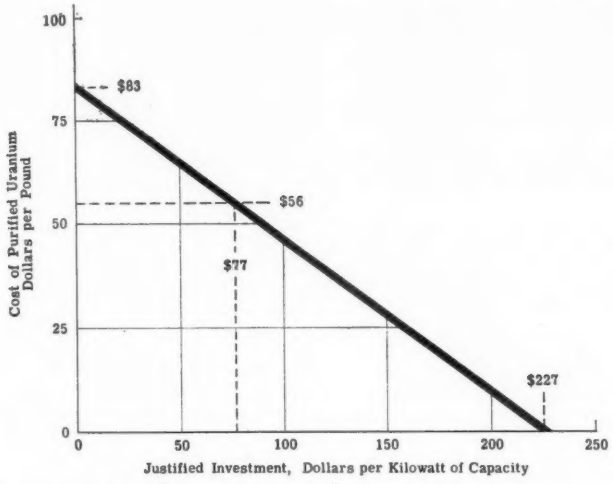
Thus, a comparison of investment costs for two methods of supplying equal heat units to the turbine throttle can be made: in the thermal plant used in this study, $77 per kilowatt; in the atomic plant, $227, under the most ideal conditions. This becomes the limit within which we must work, because if the investment exceeds $227 per kilowatt, the cost of heat at the turbine throttle would be more than by the present conventional means. Incidentally, it is hardly practical to assume that one could build a heat-power reactor which would have no fuel costs, no operation and maintenance expenses. This would amount to building a plant and then saying, "There it is, and it will go on indefinitely without doing anything about it."

I think it will be seen how important it is to define these limits as to the possibilities of investment per unit of generating capability. Of course, in systems other than our own, one might find that the $77 figure would be different and, correspondingly, depending upon the operating and fuel cost, the $227 figure would be different.

Fig. 4 is designed to show how the justified investment in a reactor would change if the ideal condition of no fuel cost could not be realized. It has been assumed that purified uranium might be used. If this could be obtained at no cost, then the investment

Annual Operating Cost St. Clair Thermal Electric Power Plant 625,000 Kw Capability		Justified Investment in Reactor-No Labor, Maintenance, or Fuel Cost (Steam Plant Annual Operating Costs Capitalized at 10%)
$ 180,000	Operating Manpower	$ 1,800,000
307,000	Operating and Maintenance Materials and Supplies	3,070,000
	Investment in Thermal Plant	48,293,000
	Fixed Charges on Investment: Depreciation 3 %, Interest 5 %, Taxes and Insurance 2 %	
4,829,300	10 %	
8,855,000	Fuel Cost (1,232,000 Tons @ $ 7.18)	88,550,000
$ 14,171,300	Total	$ 141,713,000
$ 77	Investment per Kw Capability	$ 227
$ 0.577	Cost per 1,000,000 Btu at Turbine Throttle	$ 0.577

Fig. 3—Calculation of Justified Investment in a Nuclear Heat-Power Reactor and Appurtenances.



Thermal Electric Plant Assumptions
Total Investment $98,700,000
Annual Fuel Cost $8,855,000 for 1,232,000 Tons Coal
Coal Cost Per Ton $7.18
Heating Value 11,800 BTU per Lb.
Operating Labor and Maintenance-$0.395/Ton Coal

Nuclear Reactor Assumptions
Fuel-Purified Uranium, One Pound is Equivalent to 7.23 Tons of 11,800 BTU Coal
No Operating Labor, or Maintenance Costs

Fig. 4—Justified Investment in a Nuclear Heat-Power Reactor and Accompanying Equipment, Based on 625,000-Kw Capability, 70 Per Cent Annual Plant Factor and Assuming Various Fuel Costs.

of $227 per kilowatt of reactor capacity would be justified. But with increasing cost of the purified uranium, the justified investment would decrease. When that cost reaches $56 per pound, then the justified investment in a nuclear-reactor installation would be only $77 per kilowatt, the same as for the conventional thermal plant. If the cost of purified uranium were as much as $83 per pound, then no investment at all in a nuclear reactor could be justified.

Commercial Possibilities

As a source of heat energy alone, atomic fission is unlikely to be commercially successful in the foreseeable future without assurance of additional revenue from the sale of atomic by-product materials like plutonium. There are other revenue possibilities, of course, and it is expected that in the Dow-Edison project at least, the development of these possibilities will be greatly assisted by the background and experience of The Dow Chemical Co.

One naturally asks the additional question: will the use of this new source of energy first be considered for older existing plants or for new plants to be constructed in the future? In my opinion it will be considered for the new plants first, except, perhaps, for experimental installations. In the new plants, no investment for heat generating facilities will have been made. The problem, therefore, will be that of justifying either the conventional fuel-burning equipment or the nuclear heat power reactor. This would involve a direct comparison of costs just as has been shown in connection with the St. Clair plant.

For the existing plants, where the investment for the heat-producing facilities has already been made, this direct comparison would not be possible. A justification for a reactor to be substituted for an existing boiler plant would have to include the unamortized portion of the existing investment, as well as the full cost of the reactor. Only if the annual operating cost of the existing station is greater than the cost of the new installation, taking into account both the fixed charges on the two capital investments and the reactor operating expense, would it be practical to make a substitution.

That is important, you can well understand, because there is already a great investment in thermal generating facilities. Therefore, it appears most unlikely that any development in the use of atomic fuel will affect the existing plants. As they become older, their utilization, their hours of service gradually decrease, and their output is lower. The increased investment in a nuclear reactor could be justified only where there is a high load factor, where the utilization of facilities is very great. I believe that the plants which are now in operation or under construction will serve their useful economic life before they will be superseded by another energy source. And even if atomic energy is developed with unexpected rapidity, it will affect only a part of the existing plant.

The challenge which we in the Dow-Edison project are endeavoring to meet is that of finding a type of heat-power reactor which will give us a source of heat energy and other sources of revenue that will make it possible to justify, from an economic standpoint, the investment of great amounts of capital.

The type of reactor that would be useful in an electric power system must be one for which the fuel resources are not restricted. I read recently a talk which Dr. T. Keith Glennan of the Atomic Energy Commission gave before the American Society of Engineering Education at Dartmouth on June 24, in which he said there seem to be abundant supplies of materials for this purpose.

With atomic-fuel materials of various kinds available, certainly a reactor—to be economical—would have to be one using low-fuel-cost material; it should be a reactor which utilizes high temperatures; it should be a reactor which has small exclusion-area requirements. The conventional power plant which we have been looking at may require a site of about 100 acres, whereas a reactor plant might require, under present limitation, an area of not 100 acres but 100,000 acres or more. Certainly too, the capital cost of such a reactor should be low. We, of course, are hopeful that we can develop such a reactor.

The matter of security was spoken of earlier. It is a problem which private capital and private industry must face. Realizing its importance, we certainly will cooperate. Then there is the matter of the patent situation. That also is a controlling factor. In a broad sense the present patent provisions of the Atomic Energy Act are inclined to retard the interests of private capital rather than to encourage them.

The Dow-Edison group is one of four teams carying out similar development programs. The other three are the Commonwealth Edison Co. and Public Service of Northern Illi-

(*Continued on page* 317)

The Planningest People

Gwilym A. Price
President, Westinghouse Electric Corporation

Excerpts from an address at the dedication of the Walter C. Beckjord Station of The Cincinnati Gas & Electric Co., Richmond, Ohio, June 12, 1952

THE Walter C. Beckjord Station which we are dedicating today is a splendid embodiment of the matchless economic system under which Americans live, work, and flourish. Under that system, a company such as The Cincinnati Gas & Electric Co. builds itself up to a certain stage of development. It then prepares for the next step forward. Its officers and directors carefully study needs, resources, and markets, and peer as deeply as they can into the future. They reach a considered decision, and they then proceed to give their best to put that decision into effect.

This is what is known as economic planning.

Much of the world, including far too many Americans, associates economic planning with a socialist or communist state. The left-wingers have kidnapped the phrase. Capitalism has somehow been labeled as the very opposite of planning—as a symbol of chaos and confusion.

Capitalistic Planning

Nothing, of course, could be farther from the truth. Our system works by plan, by a million plans of the kind I have just described. The American businessman, the American industrialist, the American civic leader are all economic planners. We are the planningest people you can find anywhere. Our plans have a scope, a vision, and a drive that far surpass the dreary five-year work schedules handed down by the dictators and bureaucracies of the Old World.

Our plans are not drawn and determined—at least, they have not been in the past—by a few individuals who believe they can figure it all out better than anyone else and who have nothing much to lose if their plans fail. American capitalism's plans rise out of the rich experience of a million staff men who are owners, managers, and technicians. These plans come out of the heads of the men who are the real experts in the field, who are on the scene, who risk everything on the soundness of their judgments.

This kind of planning lies at the heart of the economic system we believe in. Throughout most of this century, that system has been under constant attack from the political left, but now it stands unchallenged as the most creative, the most even-handed, and the most productive economic mechanism that man has ever developed for himself.

The collapse of socialist planning abroad, the exposure of communist tyranny, many unhappy experiences with our own governmental controls, the tremendous record of American capitalism since the war—all these have turned back the attacks of the radicals and have given our people renewed faith in this free-enterprise economy.

Socialism has been largely discredited and rejected, but there is still one special area in our economy for which socialism is widely advocated. That is the area of the public utilities.

Some of our politicial leaders pay lip service to free enterprise, yet they unblushingly demand nationalization of this part of our economic system. Some of our moulders of public opinion in journalism, teaching, and the arts are newly won converts to the concept of free democratic capitalism, but they still lash out automatically with their old-time zeal and prejudice against the "power interests," against the private investor-ownership and business management of public utilities.

The utilities have worked long and hard to place the truth before the American people, and recent howls of pain from some quarters seem to indicate that the program is succeeding. The politician who advocates public ownership of utilities is now to some extent identified correctly as an advocate of socialism, no matter what he calls it.

It is time, also, I think, to turn a spotlight on wherever the schoolroom, the newspaper column, the magazine page, the stage or the lecture platform is used to preach socialism in the utility field. I am not recommending personal attacks on individuals. I am not calling for censorship. This is a free country, and any individual has the right to believe what he chooses. But I am convinced that every unfair and uninformed attack on the concept of free enterprise in the utility field should be identified for what it is and accurately answered.

Specific and immediate attention should be drawn to every call for nationalization of a utility enterprise; to every stated assumption that the interests of the investor-owned utilities are opposed to the interests of the American people; to every misstatement on the cost and use of tax-subsidized electric power; to the hosanna that rises when government starts up a generator and the silence that reigns when investor-owned electric companies start up a dozen.

Record of Service and Growth

We have a magnificent electric system in this country, of which the Walter C. Beckjord Station is a fitting example. That system, like this station, is backed by a record of service and growth and was built by private initiative and capital operating under a dynamic free economy.

Walter Beckjord is himself a notable product and illustration of our American system. He is, moreover, an outstanding example of one of the finest features of that system—the feature that is most envied in less fortunate and less productive countries. I refer to the way in which we select our industrial leaders. Walter Beckjord has risen from young apprentice engineer to national prominence and influence in the electric industry, and he has accomplished this entirely by his ability and his eternal eagerness to give a helping hand to his community and his fellow men. It is a privilege and an honor to take part in the ceremony which for all time gives this generating station his name.

Planning Kilovar Supply

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THE problems of kilovar supply may be solved in a manner that in many ways is analogous to the method of solving problems of kilowatt supply. The advantages of this approach have been recognized for a number of years by system planning and operating personnel. One of the outgrowths of this kind of thinking has been the realization that it is necessary to base the amount of kilovar capacity on the kilovar loads, plus a reserve for contingencies. It is the purpose of this paper to develop that idea, as it applies to the Public Service Electric and Gas Co. system, and to discuss the problems of planning the location and type of kilovar capacity to be used. In particular, this paper is intended to extend the material given in a previous paper[1] in the direction of those topics of greatest present interest.

The system upon which the numerical calculations are based and to which the specific conclusions apply is that of the Public Service Electric and Gas Co. The territory is about 100 miles long and 14 miles wide, lying in New Jersey between the metropolitan areas of New York and Philadelphia. There are approximately 1,230,000 customers, and the 1951 peak load was 1,493 megawatts. The generating capacity is located in five stations, ranging from 210 to 431 megawatts.

The transmission system and interconnections are shown in Fig. 1. The bulk-supply system consists of a 132-kv ring in the northern part of the territory, where 80 per cent of the load is concentrated, and a tail serving the balance of the load, largely located near Trenton and Camden. In the north there are two 220-kv interconnections and one 110-kv interconnection at Roseland. In the south there are two 132-kv interconnections from our Trenton and Camden stations to the Emilie and Richmond stations of the Philadelphia Electric Co. A third interconection, between Burlington and Emilie, is being added. There are 13 switching stations supplying the 26- and 13-kv subtransmission networks. Approximately 83 per cent of the load is served from 26-kv lines and the remainder from 13-kv lines. The majority of the 4-kv distribution circuits are regulated.

The methods used by Public Service to determine the amount, location, and type of kilovar capacity to be installed are discussed in this paper. It is believed that the principles thus illustrated should be of general interest and applicability, although the details will naturally vary greatly, depending upon local conditions.

1. "Kilovar Supply on Public Service Electric and Gas Company System," H. K. Sels, *EEI Bulletin*, Volume 11, 1943, p. 329-32, 336.

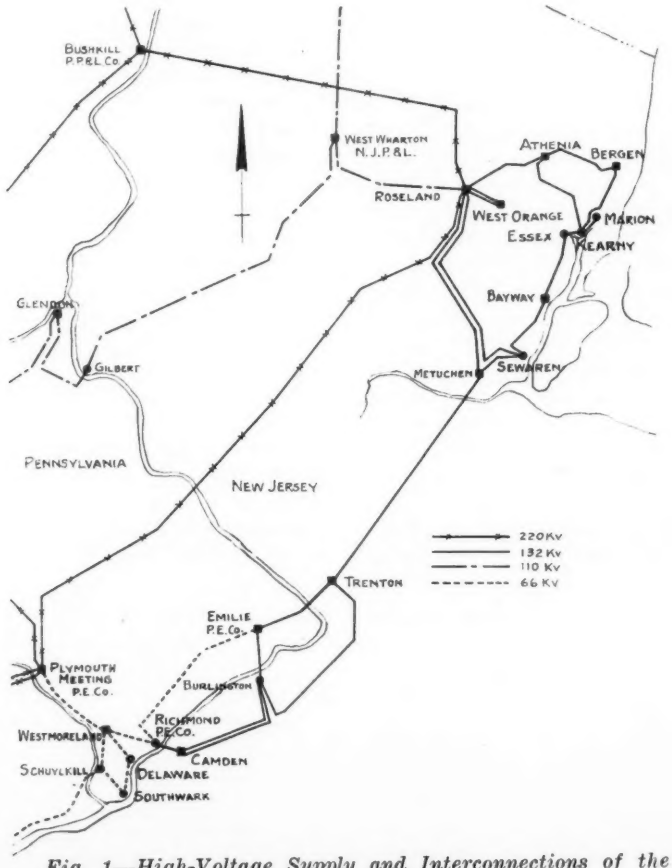

Fig. 1—High-Voltage Supply and Interconnections of the Public Service Electric and Gas Co., 1952

Forecasting Kilovar Load

The first problem in forecasting kilovar load is to define what the load includes. For historical reasons and convenience, both kilowatt and kilovar loads on the Public Service system are measured as seen by sources. The sources of kilovar supply, as defined, include interconnections, generators, synchronous condensers, and substation switched capacitors. This definition results in considering all outside-plant capacitors and all charging current not as capacity but as a negative kilovar load.

It is probably evident that a load thus defined is not readily projected in terms of its own numerical values.

The outside-plant capacitor program varies from year to year, and annual changes in the bulk-transmission component of charging current have varied from zero to 45 megavars.

For the purpose of load forecasting, therefore, the outside-plant capacitors and the bulk-transmission charging current are added in as sources. The resultant load and power factor are termed basic. Past records indicate that this basic power factor remains relatively constant for a given load condition. For example, between 1945 and 1951, the basic power factor for a winter-day period of high kilowatts and high kilovars has varied only between 69.0 per cent and 70.5 per cent. For forecasting purposes, a figure of 70 per cent can be applied to available kilowatt forecasts with considerable confidence.

Table I—System Kilovar Load Forecast

	1945-51	1952	1953	1954
Winter-evening peak megawatts	—	1600	1725	1800
Winter-day peak megawatts	—	1570	1710	1800
Basic power factor (percent)—high winter day	70	70	70	70
Basic peak megavars	—	1600	1735	1850
Outside plant megavars (effective)	—	340	340	340
Bulk transmission charging megavars	—	110	110	110
Net load on megavar sources	—	1150	1285	1400

Table I illustrates this procedure. The winter-evening peak megawatts are prepared by an interdepartmental committee with considerable attention to details. From these predictions, the winter-day loads can be derived by a projection of historical ratios or forecast directly. The 70 per cent power factor is then used to determine the corresponding basic megavars. The day peak megawatts and the peak megavars in the winter are very nearly coincident. By subtracting the effect of the outside-plant capacitors and the bulk-transmission charging current, the load on the conventional sources is obtained. No increase in outside-plant capacitors is shown beyond 1952, since the purpose of this forecast is to determine the capacity additions required.

Design Standards

The most fundamental consideration in any planning problem is the standard to which the system is designed. We believe that planning is a rather inconsistent process unless it is based on a set of rules[2]. These rules are not expected to be invariable, but they are statements of policy which it is believed will assure adequate, economical, and coordinated system design.

The standard for kilovar capacity which we have been following for the past three years is currently stated as follows:

> The total of installed kilovar capacity on either the northern or the southern portion of the system shall not be less than the estimated peak kilovar load of that portion of the system, increased by a reserve equal to the kilovar capacity of any two large generators and adjusted for reasonable interconnection and inter-area deliveries.

The division between northern and southern portions of the system for this purpose is the 29-mile, 132-kv line from Trenton to Metuchen. Experience and network analyzer studies have demonstrated that kilovar capacity and loads may be compared arithmetically in the north and in the south. The tie line, however, is better treated as an interconnection of limited kilovar capability, the amount of this capability depending upon the kilowatt flow at the time of the high kilovar demand.

Peak kilovar load, as used for this purpose, is ordinarily experienced on a day when the kilowatt load is peak or near peak. The rule would not be reasonable if this were not true. Both winter and summer conditions are investigated. From a voltage standpoint, this load level of high kilowatts and high kilovars is the most difficult condition to be met.

Provision of kilovar capacity enough to carry the load, plus a reserve for contingencies, is analogous to conventional practice for kilowatt supply. The necessity for providing kilovar reserve is just as real as the necessity for kilowatt capacity in excess of the forecast load. The amount of the kilovar reserve should be higher than the kilowatt reserve, because of the greater difficulty of transmitting kilovar reserves from one area to another (six times on the Public Service 132-kv system) and because of the larger errors in forecasting kilovar load.

These errors occur for several reasons: the kilovar load is mainly industrial and, hence, much more subject to fluctuations with the level of industrial activity than is the kilowatt load; variations in kilovar losses on the bulk-power system are substantial and unpredictable to the extent that they depend upon the particular combination of interconnection flow and generation in force at the time of peak load; kilovar metering is much less satisfactory and historical records of kilovar loads are much less complete.

Provision for reserve amounting to two large machines is based on the assumption of a forced outage overlapping a maintenance outage. While it is not normal practice to schedule a maintenance outage of a large machine during the winter peak period, it is usual to have some synchronous capacity unavailable at that time, and there are occasions when this adds up to the 60 to 80 megavars equivalent to the capability of one of the larger generators on the system. The intention is to be able to continue to provide service, although at emergency voltage levels, in the event of

Table II—Design Kilovar Reserve

	1951	1952	1953	1954
Northern generator capability:				
Megawatts	1299	1437	1574	1574
Megavars	677	762	847	847
Two largest units:				
Megawatts	239	256	275	275
Megavars	139	159	170	170
Northern winter peak load:				
Megavars	904	920	1020	1105
Design reserve:				
Megavars	139	159	170	170
Percent of load	15.4	17.3	16.7	15.4

2. "Foot Rules for System Planning," R. G. Hooke, *EEI Bulletin*, Volume 17, 1949, p. 304-8.

the forced outage of an additional single large source. During the summer months the overlapping outage of two large machines, or the equivalent, is even more probable. Since summer kilovar loads on the Public Service system are within 5 per cent of the following winter peak, it is frequently true that summer conditions govern the kilovar program.

Table II shows that the standard of kilovar reserve in the north ranges from 15.4 to 17.3 per cent of the load in the 1951-4 period. Since the standard of kilowatt reserve is 15 per cent of the load, the kilovar reserve is somewhat higher. This is to be expected for the reasons stated above. Prior to the adoption of the two-machine basis for calculating kilovar reserve, a figure of 15 per cent was used for several years. The change was decided upon because it seemed to be more rational and was easier to apply, since capacity figures do not fluctuate as much as load estimates.

The real test of a standard, however, is not its theoretical appeal but how it works. It is this test which has confirmed our belief that our present standard is at least approximately correct. In general, whenever we have been unable to install enough kilovar capacity to meet the standard, we have had trouble with low system voltage; whenever capacity up to the standard has been provided, system voltage conditions have been satisfactory.

For example, in December, 1950, our kilovar reserve in the north was down to 30 megavars instead of the 120 megavars that normally would have been provided. On the peak kilovar day, outages for maintenance and other purposes amounted to 65 megavars. This meant that 35 megavars had to be supplied by reducing kilowatt output of generation and by reducing voltage levels for additional flow from interconnections and the south. Some low-voltage trouble was experienced. The forced outage of an additional large machine, as covered by the standards, did not occur on this day, but less than three weeks later we experienced a forced outage of several smaller machines that was equivalent to a large machine. Fortunately, in the meanwhile, the amount of capacity unavailable for maintenance was greatly reduced and the loads were slightly lower, so that trouble was not encountered. If the design reserve had been available, the maintenance and the forced outages could have overlapped without causing trouble.

TABLE III—CALCULATION OF GENERATOR CAPABILITY BY STATIONS

Station	Unit	Megawatts	Megavars	
Marion	1	12.0	3.8	
	2	26.6	9.0	
	4	9.0	4.0	
	5†	8.0	12.7	
	6	8.1	4.0	
	8	8.1	4.0	
	9	18.0	8.8	
	10	120.0	65.0	
	Present total	209.8	111.3	
Kearny	1	40.0	19.0	
	2	52.0	20.8	
	3	40.0	19.0	
	4	52.0	20.8	
	5	40.0	19.0	
	6	90.0	40.0	
	1M	20.0	15.0	
	Present total	334.0	153.6	
	7*	137.5	85.0	(add in 1952)
	8*	137.5	85.0	(add in 1953)
Essex	1*	104.0	55.0	
	2	22.5	9.0	
	3	40.0	20.4	
	4	36.0	17.5	
	5	36.0	17.5	
	6	36.0	17.5	
	7	50.0	28.0	
	Present total	324.5	164.9	
Sewaren	1*	104	63	
	2*	104	55	
	3*	104	55	
	4*	119	74	
	Present total	431	247	
Burlington	1	11.0	7.3	
	2	11.0	5.3	
	3	10.0	6.5	
	4	18.0	13.5	
	5	120.0	66.0	
	6	120.0	74.0	
	Present total	290.0	172.6	
	7*	175	108	(add in 1954)

* Excluding auxiliary generator.
† 25-cycle generator; output available through frequency changre, as shown.

Calculation of Requirements

The application of the standards to the calculation of kilovar requirements is best explained by example. Table III gives the capacity of present and future generators on the Public Service system. The capability used is the maximum kilowatt capacity and the corresponding kilovar capacity. These are determined from generator output charts obtained by test or by construction[3]. Fig. 2 shows a typical chart obtained by construction. The radius of the armature current arc is taken at rated kva; the center of the maximum field current arc is the short-circuit ratio times rated kva below the origin, and the radius is taken such that the arc passes through the point of rated kilowatt and kilovar output of the generator. In some instances the maximum turbine output is greater than the rated generator output, in which case the somewhat lower kilovar output Q_2 is used instead of Q_1.

Table IV is a summary of the information in Table III, tabulated by years. To determine the firm generator capacity, the two largest machines are assumed out of service, as discussed in the preceding section. The northern and southern parts of the system are treated separately. Note that the amount of capacity rep-

3. *Electrical Transmission and Distribution Reference Book*, Westinghouse Electric Corp., 1950, p. 152.

resented by the two largest units increases in the future as the result of the installation of larger generators. In 1951 the limiting case was Marion No. 10 and Sewaren No. 4; in 1952 it is Sewaren No. 4 and Kearny No. 7; by 1953 it becomes Kearny No. 7 and No. 8. It is reasonable for the reserve to increase as the system grows. This will result automatically, since we expect the size of the largest generator to grow as the system grows[4].

Table V gives the details of the kilovar capacity available in substations and switching stations. As already explained, by definition all of these facilities are considered as generators of kilovars. The capacitors located in the outside plant, on the other hand, are considered part of the load, since their effect is to reduce the net kilovars seen by the inside-plant sources. Data for northern and southern portions are separated in this table.

In addition to the kilovar capacity available in generators, synchronous condensers, and capacitor banks in each part of the system, some kilovar capacity can be made available by transmission. This amount is limited because of the excessive voltage drops associated with large kilovar flow. Table VI gives the kilovar capacity available to the north from interconnections and from the south. The kilowatt flows shown for this emergency condition have been estimated from network analyzer studies which include the effect of the interconnections in the south. The concurrent kilovar flows are usually limited by voltage drops. In the case of the flow available from the south in 1951 through 1953, the limitation is expected to be the lack of capacity at the sending end. As indicated in the tabulation, the amount available in the north from interconnections will be increased by the installation of tap changers on the 220-kv transformer banks. Tap changers facilitate the interchange of reserve kilovar capacity.

In planning kilovar capacity for the southern part of the system, the amount that may reasonably be expected from interconnections has been determined by joint network-analyzer studies. As shown in Table VII, this amount is expected to vary from year to year, depending upon internal conditions in the interconnected company. The high var-to-watt ratio for this flow is desirable, since it reduces the kilovar flow on the relatively long 132-kv lines from the north. Within limits, the maximum total capacity is obtained by using nearby sources for kilovars and more remote sources for kilowatts. This results in greater transmission capability for a given voltage drop. Table VII also gives the megavar capability of the north for trouble in the south, based upon an emergency lowering of the voltage

Table IV—Calculation of Firm Generator Capacity by Areas

	1951		1952		1953		1954	
	Mw	Mvar	Mw	Mvar	Mw	Mvar	Mw	Mvar
Marion	210	111	210	111	210	111	210	111
Kearny:								
Present	334	154	334	154	334	154	334	154
Future	—	—	138	85	275	170	275	170
Essex	324	165	324	165	324	165	324	165
Sewaren	431	247	431	247	431	247	431	247
Northern total	1299	677	1437	762	1574	847	1574	847
Two largest units	239	139	256	159	275	170	275	170
Northern firm generator capacity	1060	538	1181	603	1299	677	1299	677
Burlington:								
Present	290	173	290	173	290	173	290	173
Future	—	—	—	—	—	—	175	108
Southern total	290	173	290	173	290	173	465	281
Two largest units	240	140	240	140	240	140	295	182
Southern firm generator capacity	50	33	50	33	50	33	170	99

Table V—Kilovar Capacity Installed in Substations and Switching Stations

	Switched Capacitors (Mvar)			Synchronous Condensers (Mvar)
	Present	Add in 1952	Add in 1953	
North	107.3	16.5	8.4	155.3
South	6.3	68.1	—	27.5
Total	113.6	84.6	8.4	182.8

4. "Generation for the 1965 Demand," F. P. Fairchild. *Electrical World*, May 22, 1950, p. 113-4.

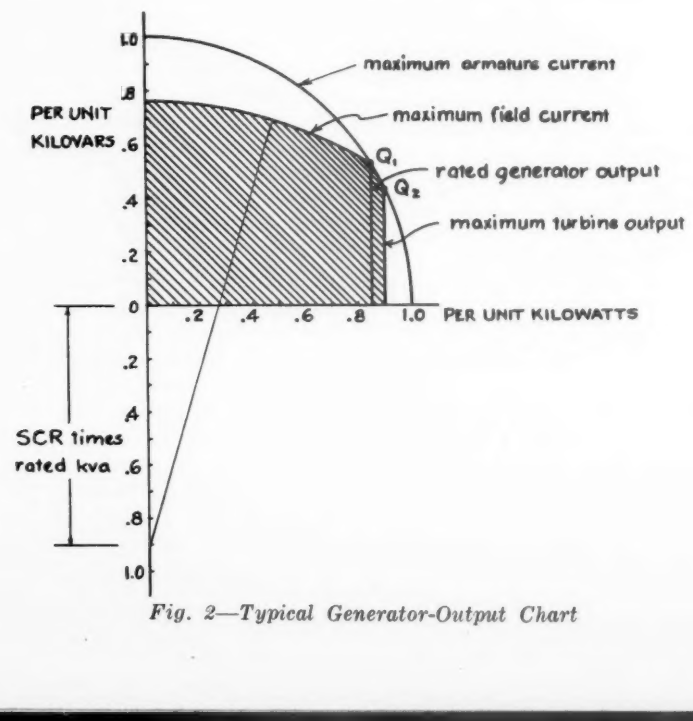

Fig. 2—Typical Generator-Output Chart

level throughout the southern area that has been accepted.

Enough information on kilovar capacity is contained in Tables IV, V, VI, and VII to compare the capacity and load in each of the two major areas. Table VIII contains the comparison for the north and Table IX for the south. For simplicity, only winter conditions are shown; in actual practice, summer conditions are also calculated and frequently are more severe than winter. The small load growth in the north between 1951 and 1952 results from the fact that an 11-mile, 132-kv cable is being installed this year. This will add some 45 megavars of charging current which appears as a negative load growth of that amount. The 1952 capacitor program in the north is being carried out entirely for local subtransmission and substation relief. No trouble was experienced in the winter of 1951, even though there was a shortage of kilovar capacity in the north, because of the unusually high availability of generators during the period of high loads. A kilovar program to avoid the deficit in 1954 is now being planned.

The situation in the south looks promising through 1954, except for 1953. The shortage of 36 megavars in the latter year is being accepted as a calculated risk in view of the fact that additional generator capacity in the south at Burlington is expected early in 1954.

It should be emphasized that this method of determining kilovar requirements is not exact down to the last 1000 kilovars or even to the last 10,000 kilovars. As has been indicated in the examples, kilovar capacities of some sources are not rigidly fixed. Increased generator kilovar output can be obtained by sacrificing kilowatt output. The kilovar capabilities of transmission sources are determined to a large extent by what emergency voltage level is acceptable. The important thing, however, is to have a method and to follow this method consistently, long enough to determine its value. Modifications and improvements can then be made.

The essence of the method used by Public Service and illustrated above is to provide enough kilovar capacity within each major area so that satisfactory voltage conditions will pre-

Table VI—Kilovars Available to North from Transmission Sources

	Megawatts			
	1951	1952	1953	1954
Northern load at time of kilovar peak	1187	1265	1360	1440
Generator capacity with 2 machines out	1060	1181	1299	1299
To be imported	127	84	61	141
From interconnections*	81	66	64	59
From south*	46	18	−3	82
	Corresponding Megavar Capability			
	1951	1952	1953	1954
From interconnections*	25	25	25	25
Add for TCUL at Roseland	—	20	20	20
From south†	30	40	10	35

* Based upon network analyzer studies.
† Limited by megavar capability of south or by voltage drop in Trenton-Metuchen circuits.

Table VII—Kilovars Available to South from Transmission Sources

	Megawatts			
	1951	1952	1953	1954
Southern load at time of kilovar peak	263	295	330	360
Generator capacity with 2 machines out	50	50	50	170
To be imported	213	245	280	190
From interconnections*	66	18	23	15
From north*	147	227	257	175
	Corresponding Megavar Capability			
	1951	1952	1953	1954
From interconnections*	102	71	75	69
From north†	52	30	20	43

* Based upon network analyzer studies.
† Calculated for 5 per cent voltage drop in Trenton-Metuchen circuits.

Table VIII—Comparison of Northern Kilovar Capacity and Load

	1951	1952	1953	1954
Firm generator capacity (mvar)	538	603	677	677
Switched capacitors:				
Present	107	107	107	107
Future	—	17	25	25
Synchronous condensers	155	155	155	155
From interconnections	25	45	45	45
From south	30	40	10	35
Total capacity (mvar)	855	967	1019	1044
Winter peak load (mvar)	904	920	1020	1105
Surplus (mvar)	—	47	—	—
Deficit (mvar)	49	—	1	61

Table IX—Comparison of Southern Kilovar Capacity and Load

	1951	1952	1953	1954
Firm generator capacity (mvar)	33	33	33	99
Switched capacitors:				
Present	6	6	6	6
Future	—	68	68	68
Synchronous condensers	27	27	27	27
From interconnections	102	71	75	69
From north	52	30	20	43
Total capacity (mvar)	220	235	229	312
Winter peak load (mvar)	195	230	265	295
Surplus (mvar)	25	5	—	17
Deficit (mvar)	—	—	36	—

vail, even in the face of a reasonably severe outage occurring at a time of heavy load. This approach should be applicable to other systems, although naturally there will be differences of opinion as to where the area boundaries should be drawn, as to what constitutes satisfactory voltage, as to what outage or combination of outages should be guarded against, and as to which seasons of the year are more critical. The best answer to these questions depends on local conditions. The details of our own solution have been presented only for the purpose of illustration. We have modified our method in the past, and we expect to develop it further in the future.

Choice of Supply Methods

The methods of kilovar supply now available include synchronous machines and static capacitor banks. The most important synchronous sources are generators and synchronous condensers. Frequency changers and motor-generator sets are used where available, but the kilovar capacity of this type of equipment is distinctly a secondary reason for its installation. The static capacitor banks may be either switched or unswitched and may be located anywhere from behind the customers' meter to transmission lines in excess of 100 kv.

The advantages of having the kilovar sources as near as possible to the kilovar loads are well known. The most important one is the reduction of the investment in system facilities required to transmit kilovars from source to load. With kilovar sources remote from the loads, the intervening transmission and transformers must be larger, and both kilowatt and kilovar sources must be larger to supply the increased I^2R and I^2X losses. Kilovar capacity supplied near the load also reduces the QX component of voltage drop, and, if the capacity is controllable in amount, the voltage variation can be decreased.

Notwithstanding these facts, some kilovar load must be planned for the generators for stability purposes. During periods of light load, operation of generators at unity power factor or even underexcited has been advocated by some authors[5, 6]. This operation is most attractive in the instance of machines of high short-circuit ratio equipped with high-speed voltage regulators. During periods of heavy load, however, when older generators and regulators are in service, ordinary practice calls for assigning some kilovar load to the system generation.

Table X—Approximate Present Costs of Kilovar Capacity and Amounts in Service

Location	Type	Dollars Per Kvar	Now In Service (Mvar)
Distribution 4-kv circuits	Unswitched capacitors	5	335
Distribution 4-kv circuits	Switched capacitors	7	2
Substation 4-kv buses	Switched capacitors	10	114
Substation 4-kv buses	Synchronous condensers	20	98
Switching station 26-kv buses	Switched capacitors	14	0
Switching station 11-kv buses	Synchronous condensers	20	85
Generating stations	Generators	3	850

Costs have a very important bearing in most planning problems. In this problem, the introduction of the cost data results in some simplification. Table X gives approximate estimated costs per kilovar for various types of kilovar capacity. They are arranged in the order of decreasing system benefit. Only those methods now employed or planned by Public Service are included in the tabulation. Since, except for kilovar capacity in substation synchronous condensers and in generators, the costs generally are increasing as the benefits are decreasing, the economic solution is to saturate the system with each type and location in turn, working down the list until the necessary amount is provided.

Table X includes the amount of each type of kilovar capacity now in service on the Public Service system. The data is presented for the system as a whole. With the exception of the switched capacitors on distribution circuits and the switched capacitors on 26-kv buses, the extent of application decreases with the increasing cost and decreasing benefit.

The largest block of kilovar capacity outside of the generators is in the unswitched distribution capacitors. This is to be expected from the discussion preceding. The 335 megavars are 22.6 per cent of the 1951 peak megawatts of 1493. Included in the total are some 40 megavars connected to tie feeders, which to some extent can be counted on to be out of service during light load periods. The minimum load reached during the 1951 Christmas holiday period was 468 megawatts and 166 megavars. By having most of the switched capacitors out of service and underexciting the synchronous condensers, the kilovar load on generators and interconections was kept up to 244 megavars, a power factor of 89 per cent. We expect to raise this gradually in the future.

The application of pole-mounted, automatically switched capacitors in the distribution plant consists of seven 300-kvar installations. The first one of these went into service about a year ago. Experience to date indicates that results are satisfactory when the device is carefully applied. Surveys indicate that 20 megavars of these devices could be added throughout the system to solve existing regulation problems. The long-range trend will probably be for this type of kilovar capacity to assume the importance its relative cost and usefulness indicate.

Installations of capacitors in 4-kv substations have amounted to 114 megavars in the last five years, with 65 megavars more planned for 1952. This capacity has been installed mostly for system reasons, but the substations selected have been those where the maximum secondary benefits could be obtained. Installations range in size from 2 to 8 megavars. Nearly half are 8 megavars; this is ordinarily the upper limit that can be installed economically at a substation. Since the cost of the circuit breaker and controls is largely independent of the kilovar capacity, the smaller installations are heavily penalized, 4 megavars being the lower limit, except for a few special cases. The smaller substations cannot absorb even this much kilovar capacity on the 4-kv bus without overloading the transformers or encountering excessive voltage variations when the capacitors are switched.

5. "Generator Stability at Low Excitation," E. L. Michelson and L. F. Lischer. *AIEE Transactions*, Volume 67, 1948, p. 1-9.
6. "Underexcited Operation of Turbogenerators," C. G. Adams and J. B. McClure. *AIEE Transactions*, Volume 67, 1948, p. 521-8.

Thus, only the larger substations are likely ones for capacitor installations, and the maximum amount that can be utilized at each of these is limited by various electrical and physical considerations. Since the trend of new substation development is toward a larger number of smaller stations, the number of likely substations for capacitor installations is not increasing much.

The substations most adaptable to capacitor installations have already been equipped. With the completion of the 1952 program, there will remain relatively few locations, perhaps less than ten, where capacitor installations can be developed economically and usefully.

The synchronous condensers in the substations and switching stations date back to the years when the substation capacitor banks were not available or were more costly. No synchronous condenser installations are now planned in the short-range future. The synchronous condensers suffer from two important disadvantages. One of these disadvantages is the obvious one of cost; the other is the less obvious one that an outage for failure or maintenance may be of long duration. The disadvantage of the long duration of outage is the possibility of an outage of another element of supply overlapping the condenser unavailability. The capacitor banks are made up of a large number of individually fused units. If one or more units fail they can be replaced during a short unavailability of the entire installation.

A failure or maintenace outage of a synchronous condenser, on the other hand, may be a matter of weeks or months. Unless replacement capacity can be provided in some way, the possibility of overlapping outage means the synchronous condenser does not add to the firm capacity of the station, according to our standards. We have planned partly to overcome this disadvantage by being ready to set up a temporary capacitor bank at any substation where a long synchronous-condenser outage occurs during a critical period. Another disadvantage of the rotating equipment is its higher losses, from five to ten times as much as static capacitors. The importance of this disadvantage depends upon whether a high or a low evaluation is made of the demand element of the cost of losses.

Synchronous condensers have several advantages which should not be overlooked. Ordinarily, an underexcited synchronous condenser can absorb about one-half as many kilovars as it can produce. Each kilovar thus neutralized at light load is worth the difference in cost between switched and unswitched capacitors. Using the costs from Table X, the lagging capability would be worth about $5.00 per underexcited kilovar, or $2.50 per overexcited kilovar, to a company installing switched capacitors in substations. The output of the machine can be varied smoothly from lag to lead, giving a stepless control of voltage which can only be approached by blocks of switched capacitors. Another advantage of particular interest to a company with regulated distribution feeders is the behavior with reduced terminal voltage. Within limits, the kilovar output of a synchronous condenser will increase, or at least remain constant, when the terminal voltage is reduced. This tends to counteract the effects of emergencies in the bulk-power and subtransmission systems, as seen from the loads.

The kilovar output of the static capacitors, on the other hand, varies as the square of the applied voltage, so that in times of low voltage, when more kilovar capacity is desired, less is available. Further quantitative study of this problem is necessary. It may show that there is a reasonable upper limit on the percentage of kilovar capacity which can come from capacitors. If this is true, the installation of part of the kilovar capacity program in the form of synchronous condensers will have to be resumed.

Table X indicates an interest in switched capacitors in switching stations, although none are now in service. An installation of two 10-megavar banks is scheduled for service this year on the two 26-kv switching station buses at Burlington Generating Station. A large block of kilovar capacity, under immediate and positive control, is needed in this area to provide for forced and economy outages of generators at Burlington and to provide capacity to handle a large growth in load now expected in this part of the territory. Switched capacitors on distribution circuits do not offer the desired controllability or amount, and the company-owned substations are too small, so the 26-kv capacitors appear to be the best solution to the problem.

The generators are the other main kilovar source used by Public Service. Table X indicates that kilovar capacity in generators becomes increasingly attractive as the bottom of the list is approached. It is generally accepted that three-dollar generator kilovars are not competitive with five-dollar kilovars in unswitched 4-kv capacitors, considering the magnitude of investment in transformers and transmission separating them. The cost of the kilovars in generators depends upon the power factor of the generator. For a 100-megawatt generator with a short-circuit ratio of 0.9, the generator kilovars between the power factor ratings of 1.00 and 0.95 cost about $1.00, whereas between 0.85 and 0.80, the cost is about $3.50. The generators purchased by Public Service since World War II have been rated at 0.85 and 0.88 power factor.

Choice of Supply Locations

After the amount of kilovar capacity required and the types of supply to be adopted have been determined, the problem remaining is the location within the portion of the system concerned. The general principle is that the installations should be where the maximum benefit is obtained. This may be determined by studying successively smaller portions of the system.

The separate treatment of northern and southern portions of the system is the first step in this process. The requirement for each of these portions is determined by the method already described. From this standpoint, the required kilovar capacity may be added anywhere within the north or south.

The next division is into the separate load areas, for example, the group of substations supplied radially from West Orange or the substations supplied by the subtransmission network between Burlington and Trenton. If such a load area is shortly to require additional bulk-supply facilities, such as an additional 132-kv transformer, special attention should be given to the possibility of delaying the additional bulk facility by the kilovar program. One- or two-year postponements of major facilities have very frequently been effected in this way. Beyond this consideration, we design

in the general direction of having the light-load power factors of the major areas about the same and also the heavy-load power factors. This rule of thumb is modified in the direction of higher heavy-load power factors for the larger areas, such as Athenia, or those that are more remote from generation, such as West Orange. A suggested refinement is to prepare a megavar load and capacity tabulation for each of the load areas separately, using an appropriate assumption with regard to the reserve requirements.

The next step is to divide the total for the load area among the substations involved. Here again attention should be given to the possibility of delaying the installation of new facilities. Frequently, additional subtransmission circuits or substation transformers can be delayed one or two years by the kilovar capacity additions. For substation installations, the smaller substations are almost automatically ruled out. Those remaining must be examined for power factor, voltage variation, and cost. The power factor at heavy load times should not be leading ordinarily, since a reduction in the substation capacity may thereby result. In general, it is undesirable to have the light-load power factor more than slightly leading because of high voltages during transmission outages. The voltage change when the capacitors are switched should be investigated to see if it is within the limits set for normal twice-a-day operation.

The distribution-circuit capacitors are used mainly to reduce circuit loadings and to raise voltages. These problems tend to occur together, and the principle of making the capacitors as useful as possible is still applicable.

After the entire program is outlined it should be reviewed for reasonability and consistency. The kilovar load and capacity forecasts are somewhat flexible. A review of the program may suggest a change of an installation from one substation to another or from one load area to another to obtain greater secondary benefit without materially affecting the main consideration.

Location of Kilovar Reserve

One of the interesting aspects of the concept of kilovar reserve is the question of where the reserve should be located. Hitherto we have been concerned with the amount of additional capacity required to meet kilovar load growth and with the details of the type and location of the new capacity. If enough kilovar reserve is provided for serious emergencies, it follows that during many of the hours in the year, reserve kilovar capacity is available but unused.

A system without switched capacitors must keep its reserve in interconnections and in its own synchronous machines. Part of the latter is in some of the synchronous condensers used for voltage control. The rest is in the generators, including those that constitute the spinning reserve.

A system with significant amounts of kilovar capacity in switched capacitors, substation and distribution, will find that it should keep some of its reserve in the switched capacitors. By the end of this year, there will be at least two substations on the Public Service system where a portion of the capacitor installations will not normally be in service, even at peak-load time. This practice will probably increase as long as the proportion of kilovar capacity in capacitors increases in the future.

In the event of an emergency condition, or a threatened emergency condition, for which these particular blocks of kilovar capacity are required in service, they will be cut in, either automatically or by a traveling operator. The alternative to this practice is to operate synchronous machines during high-load periods at higher power factors than desired. Although the quantitative answers to this problem must vary from system to system, the underlying principle should be recognized.

If a system is interconnected, some planned interchange of kilovar reserve between it and its neighbor may be mutually beneficial. The 132-kv interconnections at Trenton, Burlington, and Camden, among other advantages, make possible a mutually beneficial interchange of kilovar reserve. The process is analogous to the well-recognized practice of interchange of kilowatt reserve. It requires the sending system to raise voltage levels and to set tap changers to boost toward the receiving system. The amount of kilovar interchange thus available is limited by the usual limitations of kilovar transmission, plus the fact that the sending system has its own kilovar generation limitations. These latter limitations may be particularly restrictive at a time of high-kilowatt output, which is a likely condition when an interconnected neighbor is in trouble. This utilization of interconnections is not a new idea, but the limitations should be recognized and the capabilities utilized in planning kilovar supply.

Conclusions

1. In planning kilovar supply, systems should be subdivided into areas of limited geographical extent.

2. The kilovar capacity provided for each such area should be equal to the load plus a definite reserve allowance for contingencies. Public Service experience has been that this reserve should be equal to the kilovar capacity of two large sources in the area. A definite design standard is desirable.

3. Kilovar loads can be predicted from kilowatt and power-factor forecasts, if both past data and forecasts are corrected for charging current and capacitor installations.

4. A comparison of kilovar load and net capacity (after reserve allowance) will indicate the required capacity additions. Transmission sources should be included as part of the capacity.

5. Unswitched capacitors on distribution circuits are the first choice for kilovar capacity, up to the limit set by generator power factor at minimum load. Switched capacitors on distribution circuits are considered promising.

6. Switched capacitors can be utilized in the larger substations and are preferable to synchronous condensers at the present time. Some capacitor installations in switching stations are being made.

7. Kilovar capacity required for area reasons should be so located as to secure the maximum local benefits, usually as close to the load as practicable.

8. Consideration should be given to the location where kilovar reserve should be kept during normal conditions when not in use. Interconnections offer mutually beneficial possibilities.

Sleeve or Ball Bearings for Generating-Station Motors

*A Report of the EEI Joint Committee on Sleeve vs. Ball Bearings**

SINCE early in 1949, a joint committee of the EEI Prime Movers and Electrical Equipment Committees has been investigating and working with motor manufacturers in an effort to provide an unobstructed free choice of sleeve bearings or to make ball-bearing motors more satisfactory for generating-station service.

Members of the EEI Prime Movers Committee have been reporting at nearly every meeting since 1945 that it is becoming increasingly difficult to obtain sleeve-bearing motors in certain sizes and, in many instances, that the ball-bearing motors which were available were not proving satisfactory for power-plant auxiliaries where 24-hour service and dependability are of utmost importance. By 1949, the continuing bearing failures on essential auxiliaries and consequent loss of capacity had become so acute that the EEI Joint Committee on Sleeve vs. Ball Bearings was formed between the Prime Movers and Electrical Equipment Committees.

To obtain factual information on both sleeve- and ball-bearing motors, a searching questionnaire was sent to 71 companies with 40,000 motors. The companies were large and small in every section of the United States and, together, represented the great majority of generating capacity of this country. The results of this questionnaire and concurrent examination of experience in other fields of application disclosed some very significant facts:

1. Ball bearings have an average life under continuous operation of five to seven years, as compared to 11 to 16 years for sleeve bearings.

2. The number of forced outages reported is slightly greater with ball bearings than with sleeve bearings.

3. Sleeve bearings generally give a more adequate warning of failure than ball bearings.

4. Ball bearings are not satisfactory for spare or idle motors in turbine areas subject to double frequency vibration and consequent brineling. Examples are the turbine turning gear or emergency oil-pump motors.

5. Ball bearings are subject to many more troubles from faulty lubrication than sleeve bearings. The lubricants and methods of lubrication have not been made as uniform and simple as in the case of sleeve bearings.

6. Ball bearings require a more difficult maintenance procedure than sleeve bearings.

7. Sleeve bearings are preferred by a large majority of operating companies for all essential motors and for non-essential motors. However, in dirty locations and for vertical thrust in certain sizes, the ball bearing is acceptable or preferred.

8. Sleeve bearings are not generally obtainable or only with great difficulty in small- and medium-size motors, especially from equipment manufacturers.

9. Large and small industrials generally have found the ball bearing acceptable and prefer it to sleeve bearing.

10. The public utilities, for their special generating-station service, are but a 2 to 3 per cent buyer of motors.

From study of the data, it was evident that the ball bearing is not a wholly bad device. It is apparently acceptable to industrials at large for the reason, generally, that it requires less lubrication attention. In industrials operating on an eight-hour basis, the failure of a motor is generally not as serious a matter as is the failure of an essential auxiliary in a generating station. Also, large industrials have many motors of the same size, whereas generating stations have very few of the same size. Large industrials carry a stock of motors and have complete motor repair shops with all necessary jigs to meet the exacting requirements of ball bearing replacements. A certain number of ball-bearing failures have been caused by faulty greasing practices, such as too much and too often. It was fully realized that a serious handicap was presented by the fact that utility generating stations purchase but 2 to 3 per cent of all motors; but if the short life, replacement disadvantages, and lubrication practices are corrected, the ball-bearing motor might be acceptable for many applications. However, it is believed that utilities should be able to readily obtain motors to meet their requirements of continuous service and extreme dependability.

To review the problem, separate meetings were arranged with certain manufacturers' representatives to discuss the subject based on the following agenda which emphasized the core of the problem:

1. Unrestricted free choice of sleeve bearings in all integral horsepower sizes and speeds, with reasonable delivery. Free choice should be extended to the equipment manufacturers supplying package equipment to the users.

2. Increase the life of ball bearings as applied to motors to equal that of sleeve bearings.

3. Improve the method of replacing ball bearings to compare favorably with that of sleeve bearings.

4. Simplify the procedure for lubricating and maintaining ball bearings so that the utilities could properly improve their lubrication practices.

Meetings and discussions with manufacturers have been in progress since

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J. G. NOEST, Division Engineer, Electrical Engineering Department, Consolidated Edison Co. of New York, Inc.
W. E. SLEMMER, Electrical Engineer, Ebasco Services Inc.
R. W. WILBRAHAM, Chairman, Chief Electrical Engineer, United Engineers & Constructors, Inc.

May, 1950, and the situation with respect to availability of sleeve bearings, life, replacement, and lubrication of ball bearings is given in the text that follows:

In the matter of a free or unobstructed choice of sleeve bearings, it was recognized that the problem is not with the large motors which are standard with sleeve bearings but with the number of small motors which drive essential auxiliaries in power plants on a 24-hour basis. It is true that there is a need for improvement of lubricating practices, but this alone would not make the present ball-bearing service equal to that of the sleeve bearing. The manufacturers stated that to make the standard ball-bearing-size motors equally available in sleeve bearings could not be justified, inasmuch as there is no market for these motors outside the small number purchased by the utilities. Thus, with the exception of one manufacturer, who offers an improvement in the third quarter of 1952, the schedules to date are, in effect, unchanged. The manufacturers are aware of this condition, and there may be some improvement in the immediate future.

Manufacturers' availability tables may show considerable choice of sleeve bearings in the standard ball-bearing sizes by "special order," but experience shows that this is only an indication of the degree of reluctance to furnish the sleeve bearing. Certain manufacturers do not expect that there will be a price premium, but there will be a time premium for "special order" which might be six months.

Certain manufacturers will not encourage resalers or package-equipment suppliers to take orders for sleeve-bearing motors. The manufacturer considers it the responsibility of the purchaser to specify sleeve bearings when wanted.

The Life of Ball Bearings

In discussing the life of ball bearings, it is necessary to clarify two principal terms applied to their rating: Rating Life and Average Life. Rating Life is the life that 90 per cent of a group of like bearings operating at specified load and speed will equal or exceed before the first evidence of fatigue failure. Where reliability is the major requirement, as is the case for essential auxiliaries, it is this rating which should be used. A value between 100,000 and 200,000 hours is recommended by several ball-bearing manufacturers.

For general-purpose motors, the motor manufacturers use and rate ball bearings on Average Life and, in general, they use the same bearing in all ratings of any one frame. This Average Life should not be confused with the Rating Life previously described, since the Average Life serves only as a direct measure of production performance wherein the individual bearing loses its identity. The Rating Life of a ball bearing, by experience, is one-fifth the Average Life.

In terms of Rating Life, the questionnaire confirmed a life of two years for belt drive and five to seven years for direct drive. It was pointed out to the manufacturers that their present life values might be considered satisfactory for general purposes on an eight-hour basis, but they cannot meet the utility requirements of continuous service and dependability. The manufacturers' final stand in the matter was that to make the life of ball bearings, as applied to these motors not presently available with sleeve bearings, equal the life of sleeve bearings would increase the manufacturing cost of these motors and that this could not be done in a highly competitive market to benefit the minority buyer.

Replacing Ball Bearings

The many difficulties of replacing ball bearings—pulling couplings, obsolescence of replacement bearings, determination of tolerance for "creep fit" on one bearing, maintaining alignment, and other details of shop practice—present a much greater problem than in the case for sleeve bearings. The manufacturers could see no practical way of simplifying and improving the procedure except as might be developed through direct contact of operators with various bearing manufacturers.

Lubrication of Ball Bearings

The committee believes that it should be feasible to lubricate ball bearings with a few good greases, as is the case for oil-lubricated sleeve bearings, and the method of lubrication should be equally simple. At present, there are too many greases recommended by the motor manufacturers or no recommendation at all, and in many cases the user must, by trial and error, determine the proper grease. Also, the recommended frequency of lubrication varies so greatly that it is impractical to follow. It is obvious that these difficulties can be lessened by the preparation, on the part of the motor manufacturers, of a single set of uniform instructions for the lubrication and maintenance of ball bearings. The availability of such uniform instructions and their adoption by utilities, together with the systematic instruction of the employees in their use, would contribute to the acceptance of ball-bearing motors. The manufacturers agreed that this should be done, and in July, 1950, an effort was made to prepare a set of instructions.

In January, 1951, the manufacturers advised that it was not feasible to prepare a single industry-wide manual as the design practices of the manufacturers differed so greatly. This reply was not accepted and was returned to the manufacturers with the comment that such was not in the common interest of manufacturer and user. When it is considered that in respect to lubrication and maintenance there are but two principal types of bearings, sealed and open, the problem should not be a difficult one. If, however, all the motor manufacturers' beliefs and practices are really so divergent, then it is an open admission that ball bearings as applied are critical with respect to lubrication and maintenance. Consequently, the manufacturers were asked to give this simple matter the same cooperative effort given to much more difficult problems of standardization. This was again rejected in May, 1951, on the basis that it was impractical at that time, but the manufacturers stated the request would be retained on their calendar.

Suggested Procedure

Regardless of the complete or partial merit of the several elements of the general problem, it becomes necessary to take, within the electric utility industry, such steps as would seem advisable and necessary to improve the life of the ball bearings applied to motors that electric companies will be forced to buy in the event that they are unable to obtain sleeve bearings.

(*Continued on page* 316)

Economic Practicability of Railroad Electrification Studied in New Report

TWO years of research sponsored by 20 companies and organizations of the railroad, electric utility, electric manufacturing, and coal-producing industries have culminated in a report titled "A Preliminary Investigation of the Possibilities of Railroad Electrification in the United States," which has just been published.

The research project was initiated at Battelle Memorial Institute in February, 1950, under the sponsorship of the Joint Committee on Railroad Electrification, with directional and supervisory functions assigned to a supervisory committee. The objective of this project has been to investigate the possibilities of overcoming, through technical and other improvements, the economic obstacles to railroad electrification.

Preliminary Investigation

According to the supervisory committee's report, accompanying the findings of the Battelle researchers, the preliminary investigation has developed several salient points:

1. It appears feasible to make further railroad electrification an economic practicability.

2. Cooperative and coordinated research will lead to the improvement of the economic status of railroad electrification and will contribute greatly to the solution of many current railroad motive-power problems.

3. The future of fuel supplies available to the United States appears to be such that concerted effort should be made to encourage utilization of the relatively abundant sources of prime energy, such as coal and water power, by those industries that can economically do so, to the end that supplies of relatively limited liquid fuels will be conserved for national defense and essential services that cannot economically employ other forms of fuel.

4. The limited studies made on this subject indicate that a system of electrification, which seems worthy of further study to determine its practicability, is one having:

a. 24,000-volt, 60-cycle, single-phase contact system, with relatively light-weight overhead system and supporting structures;

b. Substation conversion equipment using static apparatus for conversion from 3-phase to single-phase power at the commercial frequency of 60 cycles;

c. Locomotives using as many component parts as possible of diesel-electric locomotives.

The study reveals certain obstacles to the expansion of railroad electrification. In the Battelle report, it is pointed out that there is a "lack of attractiveness of investment in railroad electrification to railroad and financial interests," which might be overcome by "reduction of total investment, particularly in installation-labor costs, as well as in materials and apparatus," by "reduction of risk to financial organizations," and by "mitigation of unfavorable legal and regulatory factors."

Further, there is "the complexity of engineering and construction." Suggestions for overcoming this problem include "elimination of duplication of some functions," "elimination of the need for creating a staff in each railroad for some of these functions," and the "elimination of divided responsibility for these functions among various participants."

It is also noted that although operating costs are "low by comparison with other forms of motive power," possibilities are seen for "reduction of energy costs to a minimum consistent with assuring satisfactory compensation for supplying the energy during the life-expectancy of the electrification." In addition, if the general problem of making railroad electrification attractive to investors is solved, "reduction of down-payment, annual debt-retirement costs, and interest charges" might result, as well as reduction of taxes.

These obstacles and considerations were investigated under the research program, and the results classified under three headings:

1. Technical developments which appear to be feasible;
2. Technical ideas which offer potential benefits if they can be made feasible;
3. Suggestions for overcoming deterrents of a nontechnical nature.

Three technical developments make up the first classification and were suggested to reduce the capital costs of electrification. The study notes that "because these developments appear to require only components which have already been tried, they are considered to be feasible, and can be evaluated." These developments are "the use of a contact-system voltage of 24,000 volts a-c, for distribution of electrical energy to the motive power"; "the adoption of the standard electrical utility frequency of 60 cycles per second for the contact system"; and "the use, in electric motive power, of traction motors, running gear, and other components which are already being mass-produced for diesel-electric applications."

Evaluation of Improvements

The report notes that the evaluation of these suggested improvements "is a major problem in itself," because "railroads cannot be segregated into a few typical groups, a process which might permit 'standardized' electrification." Consequently, the suggested improvements were applied to the "most recent detailed" electrification study available, completed late in 1945, which "represents the most up-to-date apparatus and techniques considered prior to this research program." The report goes on to say that "sufficient detail is included in the evaluation to permit estimating the order of magnitude of potential savings to other specific railroads."

Comparison is made in the study of relative initial investments and annual costs of rehabilitation by means of steam, diesel-electric, and electric motive power in order to perform a particular revenue service on a section of track with the following general characteristics: 400 route miles, 1634 mainline-track miles, 337 secondary track miles, 75 per cent tang-

ent track, 25 per cent curve track, 14,369,800,000 gross ton-miles of annual freight service, and 138,301,000 passenger-car miles of annual passenger service.

In the particular case under consideration, the study shows that "electrification would be the most economical method of rehabilitating motive power." "The 24-kv, 60-cycle system of electrification would be more economical for this section of railroad than any other system of electrification," the report states, noting that 10 per cent less capital investment would be required than for a conventional 3000-volt d-c system, and 4 per cent less annual expense.

Savings in Operating Costs

Either of the electrification systems "would result in annual savings in operating costs ranging from 17.3 per cent to 25 per cent in this example, as compared with either diesel-electric or steam operation, respectively," the report points out.

According to the report, the 24-kv, 60-cycle system would provide an annual return of 8.33 per cent on the extra investment over the cost of rehabilitation with diesel electrification, compared with a 3.01 per cent return on extra investment for the 3000-volt d-c system.

In the classification titled "technical ideas which offer potential benefits if they can be made feasible," the Battelle study suggests three ideas for further investigation and comments that these "affect more than two-thirds of the total investment estimated for the suggested 24-kv, 60-cycle system, as applied to the specific example."

The technical ideas are:

1. A new principle of cab signalling, which might not require: (1) track insulation to define signal blocks, (2) impedance bonds for passing propulsion current around track insulation, and (3) a signal-transmission line of special frequency along the entire route.
2. High-frequency transmission of railroad communications, through space or over wire, similar to experimental installations on existing railroads. Insofar as railroad electrification is concerned, this method might reduce the capital cost of inductive coordination associated with railroad communications.
3. A locomotive pantograph designed to impose less force against the contact wire, thereby requiring less costly contact system and supporting structures.

The third classification, "suggestions for overcoming deterrents of a nontechnical nature," is also composed of three considerations. "Like the technical suggestions in the second classification," the report states, "these suggestions offer possibilities of reducing the cost of electrification, but require further investigation of their feasibility before their potential value can be determined."

The nontechnical ideas are:

1. Formation of a plan for financing electrification, whereby the risk to financing organizations—and, therefore, the cost of financing—is reduced. The plan is based on underwriting of a part of the investment by those "other-than-financial" organizations which might gain enough from expansion of electrification to warrant assumption of a part of the risk.
2. Mitigation of risks to financial organizations as imposed by legal claims of present railroad mortgages and by the legal powers of the bankruptcy courts.
3. Formation of a "packaged" plan for combining engineering and construction functions in one responsible agency.

In its examination of the fuel picture, the Battelle study notes that

(*Continued on page* 317)

A. B. Paterson

ALBERT B. PATERSON, Chairman of the Board of New Orleans Public Service Inc. and a member of the Advisory Committee of the Edison Electric Institute, died in New Orleans, La., last August 6. He was 69 years of age.

MR. PATERSON

Born in Canada, Mr. Paterson entered the utility field in 1905 when he joined the Meridian (Miss.) Light & Railway Co., remaining with the company for 12 years as vice president and general manager. As a representative of Henry L. Doherty & Co. in 1917, he transferred his interests to New Orleans, where he subsequently entered the employ of Isidore Newman & Sons, pioneer developers of traction properties in that and other Southern cities.

In 1920 Mr. Paterson became associated with the old New Orleans Railway & Light Co. as an engineer in an advisory capacity and upon reorganization of the company under the name of New Orleans Public Service Inc. was appointed general manager. He became president of the company in 1930 and remained in that position until 1951, when he was elected chairman of the board. He was also chairman of the board of the Hibernia Bank in New Orleans, a director of Middle South Utilities, and a director of Gulf Mobile & Ohio Railroad.

An industry pioneer, Mr. Paterson was also widely known and respected for his many contributions to community development, and his death occurred little more than a year after six New Orleans civic and business organizations had united to name him "Louisiana's first citizen" and to honor him for his 34 years of public service to his adopted city (BULLETIN, August, 1951, page 258).

Mr. Paterson is survived by his widow, Mrs. Annie B. Paterson, and his three children, Mrs. John A. Mills, Mrs. Eugene H. Countiss, and Mr. Albert Brown Paterson.

An Operating Function of No Concern to Public Power Projects

How the Tax Department of New England Power Service Co. Operates

Ann F. Lord

New England Power Service Company

The following article, from the July, 1952, issue of Contact, *employee magazine of the New England Electric System, is reprinted as a concise survey of the complex duties performed by the tax departments of business-managed electric companies, duties with which public power projects need not be concerned.*

THE cost of a turbo-generator—$7,500,000—will go to the Federal government this year for taxes, and $1,500,000 to the state. And that is not all—approximately another ten million dollars will be required for various local and county taxes.

Multiplicity of Returns

The Tax Department of the New England Power Service Co. filed ten Federal tax returns for 1951. One of these ten is a consolidated return for 31 system companies; the other nine companies (Beverly Gas and Electric, Gloucester Electric, Lowell Electric, Lawrence Gas and Electric, Haverhill Electric, Salem Gas, Southern Berkshire Power, Malden Electric, New England Power) file individual tax returns because they are not 95 per cent owned by New England Electric System. The rate of this tax is now 52 per cent, and on a consolidated return it is 54 per cent.

In addition, excess profits tax returns must be prepared. These returns are filed on the same basis as the income tax returns, one consolidated and nine individual. Although ten returns are filed, there are only two companies which have to pay an excess profits tax. These returns require a substantial amount of work and detail, despite the fact that the present excess profits tax law was supposed to simplify the first law passed. The present rate of tax for companies in this category is 30 per cent of their excess profits. Excess profits are the excess of their net income, plus or minus certain adjustments required by law over their excess profits credit, which is defined in the law. It can be readily seen that it is necessary to take advantage of all allowable deductions in order to avoid overpaying taxes at this high rate.

Preparing and filing these ten Federal income and excess profits tax returns, which are paid quarterly now but by 1955 will be semi-annual, constitute the most important problem handled by this department. An extensive knowledge of accounting and Federal and state tax laws is required in order that all necessary work be coordinated before returns are prepared and filed, and that payment of all essential taxes be carried out in an established manner.

First and most important, prior to filing a tax return, an analysis of the yearly financial operations for each company in the system is made in which each and every item is studied as to its inclusion as taxable income or as a deduction for allowable expense. Deductions include such items as compensation of officers, salaries and wages of employees, losses by fire and storms, depreciation, taxes, repairs other than improvements or capital expenditures, rent, amounts contributed under pension, annuity and health plans, depreciation and gifts. A careful check of plant additions and retirements is made to determine true tax costs. After the books of the various companies are closed, an estimate is made and the return is filed.

An agent from the Bureau of Internal Revenue works with a member of the Tax Department, examining various items and schedules to substantiate depreciations, which vary from the books in most cases, until an agreement has been reached by both concerned. Consequently, agents are found checking tax returns in the Boston office about ten months of the year.

Continuing records are kept for future references and information. For management's use and for tax information to other departments in the service company, analytical records are compiled for each of the system's 35 companies.

The filing of these income and excess profits tax returns is not the only tax problem for the department. This group is kept busy handling other matters, such as the excise tax on clocks, stamp taxes on the transfer of stock, dividends paid by companies to their shareholders, the compliance under Federal tax laws as to costs of company pension trusts, and any related amendments made, consolidations and mergers of properties within the system, and until its repeal in November, 1951, the filing and payment of electric energy taxes.

Tax Law Changes

Because of constant changes and many interpretations of the Federal tax laws continually being made by the bureau and the courts, the department keeps in touch with these rulings for their application to the operations of our companies, and to assist in the preparation and filing of the Federal tax returns or in the filing of claims for refund of all or part of the tax paid. The department is constantly making studies relating to proposed tax laws, tax rate changes made or to be made by Congress to learn the effect they will have on the operations of the companies. Conferences are held with bureau representatives regarding depreciation rates. Appropriate schedules of plant and property must be

prepared and maintained to substantiate tax costs for depreciation purposes and the resulting reserve.

Because the properties of the system extend over five of the New England states, the exception being Maine, the Tax Department is confronted with a variety of laws and regulations regarding the taxation of a corporation with property or doing business in these states. It is necessary to keep up with these laws and regulations in order to file correct returns in each state and where a tax liability should accrue to see to it that the payment is made when due.

For the State of Massachusetts, the Tax Department files a corporate franchise return for the 27 system companies doing business in the state and where the company is not a public utility — New England Power Service Co.—but a business corporation, filing a corporate income and excise tax return. Vermont requires the filing of corporate franchise, four in number, gross revenue, and electric generation tax returns. Rhode Island has its business corporation tax return or a public service corporation gross earnings tax return, whichever applies. Connecticut requires a corporation income tax return, and New Hampshire a corporate franchise tax return.

Conferences are held with state tax agents regarding returns. Proposed changes by the various state legislatures are studied closely by our Tax Department to see what effect they will have on the operations of system companies. The department is often called upon by officers of system subsidiaries to straighten out tax problems. In some instances this requires a member of the Tax Department to visit the local office to get complete information and a clearer picture of the matter before a conclusion may be reached. Trips to Washington are required for conferences with Federal officials or to the revenue office of various states.

Although the Insurance Department drew up the pension plan, the Tax Department played an important part in it, as the plan had to be accepted by the government in order to become a deduction on the tax return.

All this work is carried out by seven tax accountants and a secretary under the supervision of a service company vice-president. Each man has broad experience in all forms of taxes as the work in this department is interchangeable. No one person necessarily handles the tax return for the same company twice. Keeping up with the changes in tax laws is necessary to maintain taxes at their minimum.

Plans for Production for Freedom Week Move into High Gear

PLANS for the celebration of Production for Freedom Week, scheduled for September 7-13 as a means of dramatizing the increasing expansion of American industry and the concomitant role played by electricity in this expansion, have moved into high gear, and many elements of the projected observance have already been initiated, according to the Electric Companies Public Information Program, sponsor of the project.

Emphasizing the part free enterprise and American ingenuity have played in increasing production and thereby raising living standards, the production-for-freedom program has enlisted the cooperation of industries throughout the nation. In June the American Broadcasting Co. began a 13-week series of public-service television presentations consisting of films produced by various industries. Keyed to the production-for-freedom theme as introduced by Westbrook Van Voorhis, commentator for the *March of Time*, the films will later be shown abroad by the Voice of America.

Radio Broadcasts

In addition, several industry leaders are making radio broadcasts in conjunction with the program. George W. Mason, President of the Nash-Kelvinator Corp. and Automobile Manufacturers Association, and Mark R. Sullivan, President of the Pacific Telephone and Telegraph Co., broadcast during the month of August, and on September 6, 7, and 13, respectively, Benjamin F. Fairless, President of United States Steel, Ralph C. Mulligan, of the Bituminous Coal Institute, and Donald W. Douglas, President of Douglas Aircraft, will be heard.

More than 30 leading companies—representing, among others, the aircraft, banking, chemical, coal, construction, copper, electric equipment, electric utility, insurance, railroad, rubber, and steel industries—have definitely scheduled or are currently running advertisements emphasizing the importance of electric energy to the achievement of maximum production. ECAP has announced that its mat service for the month of September will include a power-for-production ad, and the Reddy Kilowatt Service and the Bishop Publishing Co. are preparing like material.

Other Participants

The American Farm Bureau Federation has sent suggestions for participation in Production for Freedom Week to its 48 state offices, and similar action has been taken by the Associated Industries of Missouri, American Gas Association, Investment Bankers Association, and National Electrical Manufacturers Association.

National Business Publications sent information on the project to 130 trade magazines, and the Bureau of Advertising of the American Newspaper Publishers Association is forwarding suggestions for power-for-production advertising to its 1000 member papers. McGraw-Hill publications are cooperating in publicizing observances, and *Public Utilities Fortnightly* will present a story on Production for Freedom Week in an early issue.

According to PIP, endorsement of the project by the U. S. Chamber of Commerce, together with the assured cooperation of industries, business corporations, radio and TV networks, has established a basis for electric companies to demonstrate their individual and collective contributions to the nation's economic and social advancement.

As an example of plans for participation in Production for Freedom Week being formulated by operating

(*Continued on page* 319)

EEI Resuscitation Cases Demonstrate Effectiveness of Life-Saving Techniques

ESTABLISHED to promote the use of approved resuscitation techniques and to honor electric company personnel who successfully apply them in cases involving electric shock, the Edison Electric Institute Medal also focuses attention on the urgent need for increased adherence to safe work procedures so that accidents requiring the employment of artificial respiration can largely be avoided.

Resuscitation techniques are remedial measures. They are the "pound of cure" rather than the "ounce of prevention" which could eliminate most accidents in the electric industry. As such, however, they have proven very effective, and their performance has occasioned acts of heroism and devotion to duty seldom called for in everyday life.

Through an unusual turn of events, Captain W. J. Richter, Commanding Officer of the U. S. Mine Countermeasures Station, Panama City, Fla., was recently called upon to present an EEI Medal to a station employee, Fernon R. Albert, who, as an employee of the Philadelphia Electric Co., had successfully resuscitated a co-worker. Presenting the award in a ceremony described further on in this article, Captain Richter remarked:

"We like to believe that under similar circumstances we would all have done the same thing, that we would have the presence of mind to meet any situation. When the time came to Mr. Albert, he demonstrated that he was ready and able to meet and cope with an emergency."

The ability to cope with emergencies, however, is generally the result of training and experience. This is dramatically illustrated in the following summaries of resuscitations for which EEI Medals were awarded in 1951. Each of these accident case histories is not only a tribute to the courage of electric company personnel but also tangible evidence that exacting and painstaking training in resuscitation pays off in dividends of human lives saved.

Perhaps no one could be more aware of this than a person to whom life has been restored by means of artificial respiration. In another of the following cases, Lineman Estel D. Boggess, after an accident involving his resuscitation by fellow Lineman Carl E. Buck, had this to say:

"Carl's training and fast-thinking action undoubtedly saved my life. Once a thing like this happens to you, you can never forget the importance of pole-top resuscitation."

Mr. Buck concurred, saying, "In an emergency, knowing what to do and how to do it certainly makes a fellow appreciate his safety training."

In yet another manner, T. A. Albright, Division Personnel Representative, Carolina Power & Light Co., recently paid tribute to the effectiveness of the resuscitation training given electric company personnel. At the presentation of EEI awards to Joseph R. Fortner and Samuel L. Stowe, whose rescue of a coworker is reviewed below, Mr. Albright made this thoughtful comment:

"An accident was involved, but it was no accident that a life was saved."

In 1951, a total of 24 EEI Medals were authorized for presentation to electric company employees. The circumstances leading to 12 of these awards were summarized in the January and February, 1952, issues of the BULLETIN, and the remaining summaries appear on this and following pages.

SAMUEL L. STOWE (left) and JOSEPH R. FORTNER (standing center), Carolina Power & Light Co., receive EEI Medals from H. B. Robinson, Vice President in Charge of Operations and Engineering. Mr. Stowe is third man to have earned medal twice.

JOSEPH R. FORTNER and SAMUEL L. STOWE

Carolina Power & Light Company

At the intersection of Faison Road and Truck Lane, on the afternoon of August 4, 1949, Lineman Marvin T. Wells and Sub-Foreman Joseph R. Fortner were completing the transferral of an energized 2.3-kv primary from an old pole to the new pole on which they were working. All conductors were covered with rubber hose, and both Wells and Fortner were wearing rubber gloves.

Wells, however, in tying-in the primary to an insulator, contacted the end of the tie wire with his left arm above his glove, and he immediately collapsed unconscious into his safety belt, falling free of electrical contact. Fortner moved quickly up under his injured co-worker and, after determining that Wells was not breathing, began to administer Oesterreich Pole-Top Resuscitation.

Foreman Samuel L. Stowe, who had witnessed the accident from the ground, immediately sent another crew member to

FERNON R. ALBERT, who as an employee of the Philadelphia Electric Co. resuscitated a co-worker, receives an EEI Medal from Captain W. J. Richter of U. S. Mine Countermeasures Station, Panama City, Fla., where Mr. Albert works now.

GEORGE E. BENNETT accepts a Certificate of Assistance from Roy M. Godwin of the Philadelphia Electric Co.

telephone a doctor and then summoned Lineman Handy W. Thornton, working on another pole. When Thornton arrived at the scene of the resuscitation, he climbed up to Wells and secured a rope around the victim's body. After about four minutes of treatment, Wells began to breathe and he was lowered by means of the rope.

Upon reaching the ground, however, he was still unconscious, and his breathing again stopped. Stowe then began applying prone-pressure artificial respiration, which he continued for about five minutes before Wells regained consciousness and was able to breathe unassisted. In the meantime, a doctor had arrived and he drove the injured man to a clinic for observation and further treatment. Wells fortunately suffered no disability and lost no time from work.

For their successful resuscitation of Lineman Wells, Joseph R. Fortner was presented an EEI Medal, and Samuel L. Stowe, the only CP&L employee to have twice won an EEI life-saving award, was given a bar for attachment to his previously earned medal, at a dinner held in honor of the two men in Clinton, N. C., on July 30, 1951. H. B. Robinson, Vice President in Charge of Operating and Engineering, Carolina Power & Light Co., made the presentations.

FERNON R. ALBERT

Philadelphia Electric Company

Storm damage had brought down the street-light wiring on Lincoln Ave., a maple-shaded part of Philadelphia Electric Co.'s service area, and a three-man trouble crew, with Utility Man Walter T. Brown in charge, was repairing the line on the evening of July 20, 1951.

With Linemen Fernon R. Albert and Edwin R. Long at the tops of two adjacent poles, Brown, a veteran of 33 years in line work, had maneuvered a street-light truck between two of three maples in the span between the poles. High on the truck ladder amid the dense foliage, Brown, who was not wearing rubber gloves, intended to feed the street-light wire through the trees. His right hand came in contact with an energized 2.3-kv conductor, and he fell, landing first on the hood of the truck, before he hit the ground, unconscious and not breathing.

Albert and Long immediately came down the poles to the rescue of their co-worker, but at first they hesitated to turn him over for artificial respiration, fearing that they might aggravate any serious injuries received in the fall. Within two minutes after contact, however, Albert had begun prone-pressure resuscitation, and Long had called the office for an ambulance.

Troubleman George E. Bennett and Peter G. McCullough, in a company truck, heard Long's message while driving past the Upper Darby Police Station, and, after asking the police to send an ambulance, went directly to the scene. Here Bennett relieved Albert in giving artificial respiration, and within eight minutes after resuscitation was started, Brown was breathing without assistance and was taken to the hospital.

The burns which Brown had suffered were so severe that he died 23 days after the accident.

Presentation of the Edison Electric Institute Medal was made to Fernon R. Albert on April 17, 1952, at the U. S. Mine Countermeasures Station, Panama City, Fla., where he was employed as electrical engineering aid after leaving Philadelphia Electric. Captain W. J. Richter, the naval station's Commanding Officer, made the award at the request of Philadelphia Electric and a story on the presentation and rescue appeared in the April 18, 1952, issue of *Scuttlebutt*, bulletin of the Naval Station.

A Certificate of Assistance was also awarded to George E. Bennett by Roy M. Godwin, Manager of Philadelphia Electric's Safety Department, in the presence of 100 fellow employees.

MAURICE J. FLEMING

The Lowell Electric Light Corporation

For several days, pronounced radio interference had been reported in the area surrounding New Boston Rd., in the town of Dracut, Mass., and on the evening of September 14, 1951, The Lowell Electric Light Corp. dispatched Troubleman Joseph H. McCarthy to answer a call from Mrs. Mark L. Shaw, a resident of New Boston Rd., who stated that she thought the static on her radio was caused by a sparking wire which ran through the trees in front of her house.

Upon McCarthy's arrival at the scene, Mr. and Mrs. Shaw pointed out a tree limb brushing against a primary wire, which the troubleman cleared by means of a handline. This failed, however, to stop the radio disturbance, and McCarthy then discovered another limb, partially broken off, which was hanging over the primary and resting on open telephone wires. Unable to free the limb, he radioed a call for the aerial ladder truck, operated by Troubleman Maurice J. Fleming, who was presently engaged in street-light patrol work in Lowell, Mass.

When Fleming arrived at New Boston Rd., he drove the truck under the hanging limb, focused the two spot lights at the rear of the truck, and raised the ladder at a 45-degree angle. McCarthy put

on his rubber gloves, ascended the ladder and twisted the limb free. He then threw it to the ground.

Suddenly the Shaws heard McCarthy groan as he slumped over the end of the ladder. Apparently a branch of the falling limb had caused the primary to swing against his head.

Fleming jumped into the truck, moved it forward, clearing McCarthy of electrical contact, and radioed for help. He then climbed up the ladder to the injured man, who was unconscious and not breathing, and began to administer prone-pressure artificial respiration. After about ten minutes of treatment, McCarthy began to gasp and he regained consciousness, but it was necessary to continue treatment for ten more minutes before he could breathe normally.

Fleming helped his co-worker to the ground, where an ambulance was waiting to take the victim to a hospital. McCarthy was away from work for 26 days.

Maurice J. Fleming was presented an EEI Medal by Frederick G. Harriman, Safety Manager at Boston and a member of the EEI Accident Prevention Committee, at a luncheon held in Lowell on January 15, 1952. Feature stories on the rescue and presentation appeared in the *Lowell Sunday Sun* for January 20, 1952; the *Lowell Sunday Telegram* for January 20, 1952; and *Contact* for February, 1952, an employee magazine of the New England Electric System.

HAROLD W. HENDERSON

Interstate Power Company

A raging wind storm had swept the town of Elmore, Minn., during the day of August 7, 1951, and as night drew on and the wind subsided, 19-year-old farmer LuVerne Corhus and his mother discussed removing the large limb which the wind had torn from one of their trees and deposited in the street in front of their house. LuVerne told his mother that he had noticed a sagging wire near the limb and he said that he thought it was a telephone wire. Finally, at about 9:00 p.m., LuVerne left the house in order to clear away the limb. That was the last thing he remembered doing until he woke up in the hospital the following morning.

Shortly before 9:00 p.m., Service Representative Harold W. Henderson, accompanied by Maxwell Brown, both employed by the Interstate Power Co., had taken note of the fallen limb in front of the Corhus residence and had proceeded to a point about 200 feet distant in order to clear away other wind-blown debris which was affecting power service. When this work was nearly completed, Henderson told Brown that he intended to determine whether or not falling branches had damaged the power lines near the Corhus house.

The street lights were out and it was dark. Henderson picked up his saw, rubber gloves, and electric lantern, and as he walked along, he flashed the lantern around, attempting to survey possible damage. Suddenly the inert form of LuVerne Corhus was caught by the beam of the light. The falling limb had pulled a street-lighting wire down to within two feet of the ground, and, in attempting to remove the limb, LuVerne had apparently contacted the live 2090-v conductor.

The young farmer was unconscious and not breathing, and Henderson immediately shouted to Brown to summon a doctor. Henderson then began administering prone-pressure artificial respiration, which he continued for about five minutes before LuVerne showed signs of life. Following another five minutes of treatment, LuVerne's respiration was restored to normal, though he did not regain consciousness. He became so violent, however, that it was necessary to summon neighbors to restrain him until arrival of an ambulance. He was able to return to work within three days.

Harold W. Henderson was presented an EEI Medal at a special dinner held in the Methodist Church, Elmore, Minn., on February 13, 1952, and attended by about 80 businessmen, professional men, and guests of Interstate Power Co. E. R. Lehman, Interstate Power Safety Director, reviewed the accident, and L. L. Peterson, Assistant to the President, made the presentation. Stories on the rescue and the award appeared in *The Elmore Eye* of February 14, 1952, and in the 1951 holiday issue of the company employee newspaper, *Interstate Power News*.

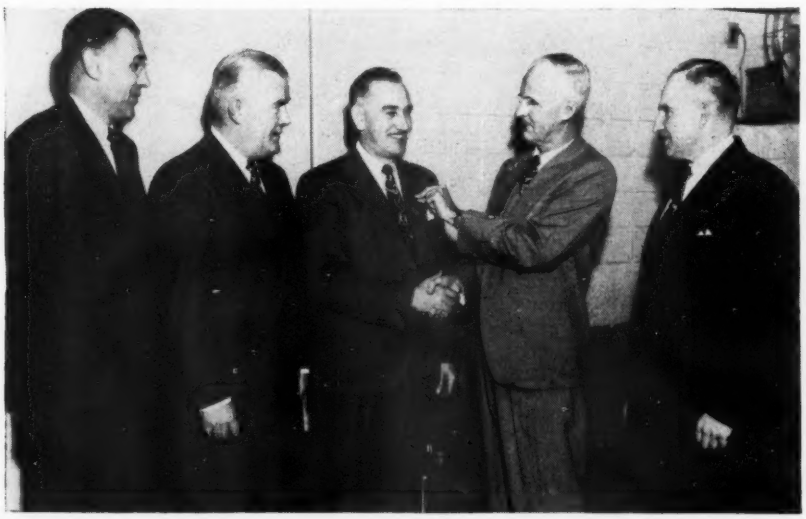
ANTHONY C. VIGLIOTTI

West Penn Power Company

As a member of a line crew engaged in converting a circuit from 4 kv to 8 kv near Granville, Pa., on September 15, 1951, Lineman Robert C. Sproull was on a pole, connecting main-line jumpers to dead-end discs. He was straddling an anchor guy, which had just been grounded, and neither the guy, the energized conductor on which he was working, nor the neutral wire were covered with protective rubber.

Suddenly other crew members, who were at the company truck near the pole where Sproull was working, heard a noise resembling a fuse blowing and saw the lineman collapse in his safety belt. Sproull had received a 4-kv shock when, in some manner, he contacted an energized jumper clamp with the unprotected portion of his left arm above his rubber glove. He was hanging head downward, knees bent, with his gaffs still in the pole.

Lineman Paul Grandel immediately put on his climbing tools and made his way up to the victim, who was unconscious and not breathing. Grandel was quickly followed up the pole by Lineman Anthony C. Vigliotti and Merle G. Martin, and after the three men had righted Sproull in his belt, Vigliotti began to administer pole-top resuscitation. Treat-



MAURICE J. FLEMING, Lowell Electric Light, accepts EEI Medal from F. G. Harriman, New England Power Service Co., for reviving J. H. McCarthy (right), as LEL Safety Supervisor H. O. Faust (left) and Vice President T. J. Hickey watch.

HAROLD W. HENDERSON, Interstate Power Co., displays the EEI Medal and Certificate awarded him.

ANTHONY C. VIGLIOTTI (second from right) receives congratulations from P. H. Powers, President of West Penn Power Co., for winning an EEI Medal. Pictured left to right are C. H. Snyder, Brownsville District Manager, and crew members who aided Mr. Vigliotti, including MERLE G. MARTIN, FRANCIS D. MILLS, R. J. FLEMING, and PAUL GRANDEL.

ment was continued for three minutes before Sproull began to show signs of life and for two minutes more before he was able to breathe without assistance.

After the victim had been revived, his rescuers rigged a handline and lowered him to the ground, where he was placed on rubber blankets and given ammonia inhalations. Upon arrival of a doctor and an ambulance, Sproull was taken to a hospital in Brownsville, Pa., where he was treated for shock and burns. Though he was away from work for a month, he suffered no permanent disability as a result of the accident.

Anthony C. Vigliotti received an Edison Electric Institute Medal and Paul Grandel and Merle G. Martin Certificates of Assistance at a special dinner held at the Nemacolin Country Club on March 20, 1952. West Penn President P. H. Powers made the presentations. Articles on the awards appeared in the *New Bethlehem Leader Vindicator* of April 2, 1952, and in the April issue of *West Penn News*, company employee magazine.

MASONTOWN LINE CREW

West Penn Power Company

South of U. S. Route 119 between St. John's Church and Hope Hollow Run, on the morning of September 17, 1951, a line crew was engaged in reinsulating a de-energized branch of a 6.9-kv circuit, in preparation for conversion to 12 kv. Lineman Joseph P. Raubaugh and P. L. Erhard had been assigned the reinsulation of a transformer pole, and when the operation was completed, Raubaugh signaled from the pole to Foreman Joseph G. Battaglia on the ground that the line could be re-energized.

To make sure that he had understood the signal correctly, Battaglia got further assurance from Raubaugh that all was clear before he ordered the line to be closed. Then, as the two linemen started down the transformer pole, the roar of an arc was heard, and Raubaugh plummeted 23 feet to the ground. During the fall, his body nearly brushed Erhard from the pole.

Erhard immediately descended and went to the aid of the injured man, who was unconscious and not breathing. With the help of Groundman Donald B. Christopher, Erhard turned the victim over and began administering prone-

The Masontown Line Crew receives EEI Medal Miniatures from President Powers. Pictured left to right are C. L. Stotler, Masontown District Manager, Mr. Powers, JOSEPH G. BATTAGLIA, DONALD B. CHRISTOPHER, CHARLES R. CUMLEY, JOHN BILLAK, and PERCY L. ERHARD. GEORGE F. RILEY, another member of the crew, was unable to attend the presentation ceremony.

pressure artificial respiration, while Battaglia massaged Raubaugh's limbs and Lineman John Billak summoned an ambulance and a doctor over the truck radio.

Raubaugh did not respond to treatment quickly, and in the course of 30 minutes, Christopher, Billak, Truck Driver Charles R. Cumley, and Groundman George F. Riley also performed respiration before the victim was able to breathe without assistance. Upon arrival, the doctor found Raubaugh in an extreme state of shock, and, still unconscious, the injured lineman was taken in an ambulance to a hospital.

It is believed that Raubaugh, after signalling to have the circuit energized, had slipped upon taking his first step down the pole and had contacted the transformer riser with his right hand. Inasmuch as the circuit had been dead during the course of his work, he was wearing only canvas gloves, which offered no protection against electrical contact. Despite his successful resuscitation, Lineman Raubaugh never regained consciousness, and he died in the hospital four and one-half days after the accident.

For the skillful rescue and administration of life-saving techniques, all members of the Masontown Line Crew were awarded EEI Medal Miniatures at a special dinner held on April 2, 1952, at the Nemacolin Country Club. The presentations were made by P. H. Powers, President of West Penn, and articles on the ceremony appeared in the April 2, 1952, issue of the *New Bethlehem Leader Vindicator* and the April issue of *West Penn News*, company employee magazine.

LEONARD H. ERNST

Gulf States Utilities Company

Returning home from an evening drive with his wife and family on March 12, 1951, Line Foreman Leonard H. Ernst stopped his car at a corner in Lake Charles, La., where he noticed a fellow employee, Electric Serviceman Joe Billy Corbello, on a pole, working on a defective street lighting circuit. When Corbello was unable to locate the trouble, Ernst volunteered to help him check the circuit, and the two men drove off together in the company truck.

At the corner of Kirby and Kirkman Streets, Corbello saw that a tree limb adjacent to the circuit was burning, and he stopped the truck. Ernst helped him rig a hot stick, attaching a saw to one end of it, and handed it to Corbello, who began to ascend a pole. Ernest was walking back to the truck when he was startled by the roar of an arc and, turning, saw his companion hanging from the pole, fire encircling both hands. Corbello had contacted the street lighting fixture, which had become energized for undetermined reasons.

The injured man hung on the pole for a few seconds before falling to the ground. Ernst immediately sent out a call for help over the truck radio and then ran to Corbello, who was unconscious and not breathing. Beginning prone-pressure artificial respiration within one minute after the accident occurred, Ernst continued treatment for eight minutes before the patient began to show signs of life and for another two minutes before his respiration was restored to normal. The accident attracted the attention of several passing motorists, who stopped to render assistance and helped move the victim into a waiting ambulance.

Despite the effectiveness of his resuscitation and prompt hospitalization, Corbello's burns necessitated amputation of both of his forearms.

Leonard H. Ernst was awarded an EEI Medal at an outdoor meeting of approximately 150 employes of Gulf States' Lake Charles Division on the evening of May 23, 1952. George R. Fulton, Vice President and Division Manager, Gulf States Utilities Co., made the presentation in a ceremony attended by Mr. Corbello. A story on the presentation appeared in the company magazine, *Plain Talks*, for June, 1952.

CLAYTON P. PIERCE

Tampa Electric Company

On the morning of July 2, 1951, Lineman D. E. Lambertson and Groundman W. M. Tooke, Jr., members of a Tampa Electric Co. line crew, were engaged in dead-ending a conductor on a pole located at the corner of Boyette and McMullen Roads, southeast of Tampa, Fla. The rest of the crew had driven three poles distant in the company truck in order to work on another phase of the operation.

After covering the conductor with line hose on either side of the pole, Lambertson attached a temporary jumper to one side of the conductor, and then reached over a crossarm in an effort to secure the other end of the jumper to the far side of the conductor. This position brought his shoulder up against the line hose, which apparently opened sufficiently to enable his right arm to contact the live conductor.

Lambertson's call for help in a moderate tone of voice alerted Tooke to the accident, and the groundman immediately shouted for assistance to the rest of the crew. Though Tooke attempted to maneuver a hand line in order to free the victim from contact, Lambertson was on the live wire for about five seconds before his hooks cut out from the pole and he slumped back into his safety belt.

Responding to Tooke's shouting, other crew members backed the truck up to the scene of the accident in order to save the time involved in turning the vehicle around on a narrow road. Lineman Clayton Pierce, who had his climbing tools on, then climbed up the pole under the injured man. Lambertson was unconscious and not breathing, but after applying Oesterreich Pole-Top Resuscita-

LEONARD H. ERNST receiving an EEI Medal from G. R. Fulton, Vice President and Division Manager, Gulf States Utilities Co.

CLAYTON P. PIERCE (right) displays the EEI Medal and Certificate he received for resuscitating D. E. Lambertson (left). Francis J. Gannon, President of Tampa Electric Co., presented the award.

CARL E. BUCK (right) is congratulated by D. C. Duncan, System Safety Supervisor, Appalachian Electric Power Co., for the resuscitation of Estel D. Boggess (center).

JOSEPH E. CANTLEY JR., (right) is presented an EEI Medal by F. R. McMeekin, Vice President in Charge of Operations, South Carolina Electric & Gas Co.

tion for about three minutes, Pierce was able to restore the victim's respiratory powers. Having regained consciousness, Lambertson was assisted to the ground, whereupon he was taken to a doctor's office in Tampa for treatment of burns. He suffered no disability and lost no time from work.

Clayton P. Pierce was awarded an EEI Medal during Tampa Electric's Annual Safety Carnivals, February 26, 28, and 29, 1952, in the presence of 90 per cent of the company's employees, accompanied by their families, an over-all attendance of approximately 2300 people. Francis J. Gannon, President of the company, made the presentation in a ceremony in which Mr. Lambertson participated.

CARL E. BUCK

Appalachian Electric Power Company

Two Appalachian Electric Power Co. linemen, Carl E. Buck and Estel D. Boggess, were on a pole in Smith Road, Charleston, West Va., on the morning of August 9, 1951, methodically carrying out their assigned task in connection with the reinsulating of a 4-kv power line, preparatory to converting it to 12 kv.

Boggess and Buck were to eliminate a single-phase 2.4-kv dead-end and cut the line straight through. On their way up to their working positions on the pole, they had covered all the wires, including the primary. They had also disconnected the primary riser from the transformer cut-out and rolled it up, de-energizing the secondary and leaving only the single-phase primary hot.

The two men then proceeded to install a sleeve connection so that the primary would be continuous. A number of twists had been put in the sleeve, when Boggess, reaching up under the wire with his left hand to continue splicing, touched a clamp on the primary with his left arm just above the cuff of his rubber glove. Falling into the cumalong, he was rendered unconscious and his breathing stopped.

Buck immediately knocked him free of contact and moved around the pole to give Boggess Oesterreich Pole-Top Resuscitation. The victim was revived in less than five minutes, climbed down the pole unassisted, and was taken in a line truck to Charleston General Hospital. Treatment of burns, including some skin grafting, necessitated about two months' lost time for Boggess.

In presentation ceremonies in February, 1952, which were reported in that month's issue of *The Illuminator*, Appalachian Electric's company publication, Carl E. Buck received the Edison Electric Institute Medal from D. C. Duncan, System Safety Supervisor, with Estel D. Boggess watching as an observer with a deep personal interest.

JOSEPH E. CANTLEY, JR.

South Carolina Electric & Gas Company

With Foreman J. A. Brodie in charge, the Summerville line crew of the South Carolina Electric & Gas Co. went out on the morning of October 26, 1951, to check radio noise along a 7.2-kv line near Holly Hill, S. C.

In the process of sectionalizing the line to determine where the noise occurred, the crew was breaking the line at one point when Foreman Brodie dispatched Journeyman Lineman J. W. Swicegood and Second Year Apprentice H. H. Folden to a junction pole about 2500 feet distant to open the section for test.

Brodie, in radio communication with Folden, told him that all was clear at the first point and ordered the jumper taken off at the junction pole. Swicegood, on the pole, removed the jumper, and Folden reported back to Brodie that the line was broken. Brodie, at his end, had Lineman Joseph E. Cantley, Jr. close the switch, which energized the line to the junction pole, and radioed Folden to the effect that the line was hot, that the noise was gone, and that the trouble must be beyond the junction pole. He then instructed Folden to ground the line.

Apparently, without repeating the message to Swicegood on the pole, Folden passed a handline to his co-worker and went to the truck for grounding equipment. Suddenly Folden heard a noise and, turning, saw Swicegood fall back in his safety belt.

Folden radioed Brodie, who, with the rest of the crew, was already en route, and within two minutes after the accident, Cantley was on the pole under Swicegood, who was unconscious and not breathing. After about four minutes of Oesterreich Pole-Top Resuscitation administered by Cantley, Swicegood returned to consciousness and was lowered to the ground with the help of Brodie and Folden. Swicegood was then taken in a company truck to a Holly Hill doctor's office.

It developed that Swicegood, overhearing the radio messages, had misunderstood Brodie's last report. Thinking that the line was still dead, Swicegood had contacted the energized short jumper with one hand and the guy with the other hand. He suffered burns on his fingers, but he lost no time from his job.

In a ceremony on February 20, 1952, Joseph E. Cantley received the Edison Electric Institute Medal from F. R. McMeekin, Vice President in Charge of Operations of South Carolina Electric & Gas. Also honoring Cantley at the presentation were Mayor Albert H. Peters of Summerville; H. A. Petit, Vice President and Manager of the Charleston Division; and J. L. Weeks, Safety Director. Photographs and articles covering the award were carried in the *Charleston Evening Post* of March 5, 1952, *The Summerville Scene* of March 7, 1952,

CHARLES F. KOFMEHL (left) receives congratulations from the man whose life he saved E. F. Eckhoff. Displaying his Certificate of Assistance is H. B. CARROLL, with E. W. Flentje, Assistant Division Manager, Iowa Public Service, at right.

and in the March issue of the company magazine, *Live Wires.*

CHARLES F. KOFMEHL

Iowa Public Service Company

On the morning of September 25, 1951, in a wooded area thick with underbrush near the town of Lake View, Iowa, two construction crews had been engaged in removing sections of a 34-kv transmission line from poles which also supported a 2.3-kv farm-line underbuild. Having killed the farm line, the crews had untied the transmission wires, dropped them to the ground, and then rolled them up for collection by another crew later in the day. This operation completed, the farm line had been re-energized.

It was cold with a light rain falling that afternoon when a crew, under Foreman H. B. Carroll, went out to pick up the wire deposited along the road side. Followed by the rest of the crew on foot, Apprentice Truck Driver and Groundman Edward F. Eckhoff would stop the truck periodically to allow the crew to load it with collected material. At one point, seeing what he thought was a short piece of wire with one end stuck in the ground and the other end hidden by brush, he got out of the truck and picked up the wire in his unprotected hand.

Carroll saw the wire starting to arc in the brush, and he shouted to Eckhoff to drop it, but the groundman's body became rigid, and the wire remained clasped in his hand. Unknown to the crew, the hidden end of the wire had been caught in a tree and was resting over one phase of the 2.3-kv circuit.

Running to the truck for his rubber gloves, Carroll alerted his co-workers to the accident. He then returned to the victim, who was unconscious and not breathing, and freed him of electrical contact. Lineman Charles F. Kofmehl immediately rolled the injured man over and began administering prone-pressure artificial respiration, and after about three or four minutes of treatment, the victim was able to breathe without assistance. Eckhoff, in a state of shock, was taken in an ambulance to the hospital, but his injuries were slight and he lost no time from work.

This was the second time in the last two years that Lineman Kofmehl had saved the life of an electric-shock victim through the use of prone-pressure artificial respiration, and for his most recent valorous action he received the EEI Medal at a safety meeting held for employees of Iowa Public Service Co. in Carroll, Iowa, on February 15, 1952. At the same time, H. B. Carroll was awarded a Certificate of Assistance. The presentations were made by E. W. Flentje, Assistant Division Manager, in a ceremony which was described in a feature story appearing in the *Carroll Daily Times Herald* for February 16, 1952.

JOHN F. NICHOLSON

Duquesne Light Company

In a rural section of Duquesne Light Co.'s service area, a three-man line crew undertook a familiar job on the morning of August 20, 1951—the installation of a transformer on a 35-foot pole.

Lineman Harry J. Scheidemantel, who was in charge, and Lineman T. E. Laszlo contacted customers to be affected by outages, while Lineman John F. Nicholson began placing protective rubber on lines and installing equipment needed to lower the old transformer and substitute the new one.

When Scheidemantel and Laszlo returned from their rounds, the new transformer was placed on the pole, and Scheidemantel went up the pole while Nicholson was arranging the secondary rack. There was a flash, a cry of "Help me, Nick," and Scheidemantel fell from the primary arm across the secondary wires. After instructing Laszlo, who was on the ground near the truck, to telephone for aid, Nicholson immediately moved around the pole to get Scheidemantel in position for pole-top resuscitation.

The victim's weight shifted in such a way as to make it impossible for Nicholson to give resuscitation in the normal

JOHN F. NICHOLSON (left front) received EEI Medal from W. G. Jens, Vice President, Duquesne Light Co., in a ceremony in which several employees received other safety awards. T. E. LASZLO (left rear) won EEI Certificate of Assistance.

manner, but he applied the respiration technique as best he could, awaiting Laszlo's return from a house across the street. On seeing what had happened, Laszlo put on his tools and climbed the pole.

Scheidemantel began to revive slightly as Laszlo got in position to give regular pole-top resuscitation. After he was conscious, Scheidemantel was helped down the pole, and prone-pressure artificial respiration given him on the ground for about ten minutes, until he could breathe without assistance. He was taken in an ambulance to Rochester General Hospital, after a doctor on the scene pronounced his heart in good condition. Nicholson and Laszlo then completed the job which had been interrupted by the accident.

It was ascertained that in some manner, Scheidemantel's elbow had contacted a short lead, not covered by rubber, connecting a phase wire of the 4-kv circuit with a cut-out. As a result of burns received, he lost five days of working time.

At a presentation ceremony on June 11, 1952, conducted by W. G. Jens, Duquesne Light's Vice President in Charge of Operations, John F. Nicholson received the Edison Electric Institute Medal, and T. E. Laszlo received a Certificate of Assistance. The *Pittsburgh Post-Gazette* reported the event on the following day.

Text Widely Adopted

A COMPREHENSIVE and authoritative treatment of accounting methods, practices, and problems peculiar to regulated electric and gas utilities, *Public Utility Accounting*, by J. R. Foster and B. S. Rodey, Jr., has been adopted by a number of operating companies and educational institutions since publication in 1951.

Among the companies now making use of the 690-page volume are The Cincinnati Gas & Electric Co.; the Consolidated Edison Co. of New York, Inc.; The Dayton Power and Light Co.; The Detroit Edison Co.; the Kansas City Power and Light Co.; and the Washington Gas Light Co.

In addition, the University of Michigan, University of Miami, St. Peter's College, University of Toledo, University of Tennessee, and Washington University are now using the work in quantity.

Public Utility Accounting, published by Prentice-Hall ($10.00) was reviewed by H. C. Hasbrouck, former Institute Accounting Director, in the July, 1951, issue of the BULLETIN and by H. H. Scaff, Vice President of Ebasco Services Inc., in the August, 1951, issue of *Controller*.

Sleeve or Ball Bearings

(*Continued from page* 304)

It is believed the most effective method of improving the present situation is:

1. To continue the reporting of bearing failures by operating companies.
2. To write into specifications for ball or antifriction bearing motors the following statements that will define, in established terminology, the expected hours rating life, and to request the manufacturers' recommendations for proper lubrication and procedure for removal and replacement of ball bearings:

Sample Statement on Certain Essential Features of Antifriction Bearings

1. *Bearing Rating Life* — For power-station auxiliary motors equipped with ball or roller bearings, the bearing Rating Life in hours, at motor full load and speed, shall be not less than 132,000 hours (15 years) on the basis of 90 per cent of a group of like bearings completing this number of hours of operation under like conditions of load and speed before first evidence of fatigue develops.

2. *Lubrication* — Proper bearing lubrication maintenance being essential to satisfactory operation, motors equipped with antifriction bearings shall be shipped with printed instructions covering lubrication details including: recommended lubrication inspection and replacement periods, recommended quantity of lubricant and kind of replacement lubricant, oil-level sight gauges marked to show proper level for standstill and running conditions.

3. *Bearing Replacement* — Full identification shall be given of bearings installed in new motor, and of possible replacement bearings of two or more makes. Instructions should be included on bearing removal and replacement procedure details.

In the persistent use of these statements, the utilities are not unqualifiedly accepting the ball-bearing motor. The position is being maintained that a free choice of sleeve or ball bearing is the desired objective and a logical solution to the problem. In any case, a single industry-wide instruction manual on lubrication and maintenance of ball bearings is a requisite.

Valor Award Prize Donated to Boys' Town

The 23 Union Electric Co. of Missouri employees who won the Matthews Valor Award at the EEI Convention last June presented the award's cash prize to Boys' Town of Missouri in a recent ceremony. Some interested award recipients later installed an intercommunicating system in the institution on their own time. Award winners and guests participating in the ceremony were (back row, from left) M. F. Bruns, W. R. Sorby, K. L. Dolde, R. J. Shillito, C. R. Classen, H. M. McGuire, J. A. Jobe, J. F. Miklovic, Chester Keller, H. D. Rilling, (front row, from left) E. W. Fahrenhorst, S. S. Starr, H. O. Biermann, J. W. Gilbert, Bill James, Boys' Town president, E. J. Giltner, I. L. Ditch, A. R. Smith, L. J. Watts, D. D. Walkenhorst.

Report on Railroad Electrification

(*Continued from page* 306)

from 1945 to late 1950, diesel fuel costs have increased "30 per cent faster than electrical-energy costs," and refers to a prediction of the "Economic Survey Report on the Fuels Outlook, 1950-1970," that "diesel fuel costs will continue to increase more rapidly than electrical energy costs."

The Battelle report goes on to say that "an increase of 10 per cent in the price of diesel fuel, or about 1 cent per gallon in the Eastern District, would increase the savings of the suggested 24-kv, 60-cycle system over diesel electrification by more than $675,000 annually." The Survey Report on Fuel Outlook predicts that prices for diesel fuel might increase two and one-half to five times this amount in terms of 1950 dollars during the next 20 years, if no major war occurs during the interval, a development which would hasten the effect and, in addition, create difficult problems of securing satisfactory qualities of this fuel.

"In contrast," the Battelle study goes on, "a 10 per cent decrease in the cost of electrical energy, about 1 mil in this particular example, would increase the savings about $612,000 annually. The fuels report indicates that a reduction of at least the above amount in terms of 1950 dollars might be expected during the next 20 years."

Using these predictions as a basis, the Battelle report states that "the trend during the next 20 years is expected" to show a significant decrease in annual expenses of electric operation as compared with diesel-electric operation and, in the specific example under study, annual savings for the 24-kv, 60-cycle system, as compared with diesel electrification, would increase from $3.3 million to between $5.6 million and $7.2 million.

The Battelle report, "A Preliminary Investigation of the Possibilities of Expansion of Railroad Electrification in the United States," will be available at $1.00 a copy from the Edison Electric Institute, 420 Lexington Avenue, New York 17, N. Y., or from Bituminous Coal Research, Inc., 2609 First National Bank Building, Pittsburgh 22, Pa.

A very limited supply of the report, complete with appendices, is available from the Edison Electric Institute at $10.00 per copy.

Sponsors of the research project were: Railroads—Baltimore and Ohio Railroad, Chesapeake and Ohio Railway Co., Erie Railway Co., New York Central System, Norfolk and Western Railway Co., Pennsylvania Railroad Co., Virginian Railway Co.; Electric Utilities—Edison Electric Institute; Electric Manufacturers—Anaconda Wire and Cable Co., General Electric Co., Kennecott Wire and Cable Co., Ohio Brass Co., Phelps Dodge Corp., Steam Locomotive Research Institute, Westinghouse Electric Corp.; Coal Producers—Appalachian Coals, Inc., Bituminous Coal Research, Inc., Fairmont Coal Bureau, Ohio Coal Association, Pittsburgh Consolidation Coal Co.

Electric Power Systems and Nuclear Power

(*Continued from page* 293)

nois; Pacific Gas and Electric Co. and Bechtel Corp.; and Union Electric Co. of Missouri and Monsanto Chemical Co. I am sure that they are making progress also.

A report by the President's Materials Policy Commission, dated June, 1952, and entitled "Resources for Freedom," has just been released. In connection with the participation of industry and particularly these four groups concerned with electric power development and other industrial use, the report recommends:

> That the present cooperative arrangements between the Atomic Energy Commission and privately owned electric utility companies and other interested companies and groups for developing economical ways to obtain electric power from atomic sources be continued, and that the tempo of development work in this field be kept at the maximum level permitted by urgent security demands upon supplies of fissionable materials and technical personnel engaged in the atomic energy program.

I do want to repeat in closing that private capital has a very important role to play in this great development, probably the greatest responsibility that private capital has ever faced in its history. I want to emphasize again that private capital faces a challenge and an opportunity that is unprecedented. We must look many years ahead. Atomic energy is a great discovery, probably the most far-reaching discovery mankind has ever made. The electric-power systems of this country and of other countries should be intensely interested in its development. There is no evidence that there can be early results, but certainly the investment, the research, and the development necessary to produce results are well justified.

At its present stage, atomic energy is a development which industry and government must carry out together. The world situation is so critical that not only the need for additional sources of energy but also the need for additional sources of materials extremely important to the defense of this country and all the democracies allied with us are involved.

It seems to me also that if it is possible to develop the peacetime use of atomic energy as a heat source for industrial purposes, it may give us one of the best means of combating the spread of communistic influence over the other parts of the world. There are other countries, with no great fuel resources like our own, which need atomic energy more than we do. When you think of some of the countries in Western Europe, such as The Netherlands, Belgium, and France, you will realize that.

It is only a few weeks ago that the Queen of the Netherlands visited this country. I had occasion to talk with her on the subject of electric power and atomic energy and in brief she said, "You know our coal reserves are rapidly dwindling and we must plan for the future supply of our heat energy needs." She said she believes this problem can be solved only through the development of this newfound source of energy, atomic energy.

Private capital and private industry—the electric industry in particular—indeed have a great deal at stake in this development. I believe industry is justified in putting not only its funds but also its best manpower to work towards the broadening and strengthening of this industrial participation. And I am most hopeful that out of it will come a real contribution to improving the standard of living in this country and other countries of the world.

Personals

John E. Corette, Jr., Vice President and Assistant General Manager, The Montana Power Co., has been elected President and General Manager, succeeding **Frank W. Bird,** who has been named Chairman of the Board after serving the company as chief executive for more than 12 years. **C. J. Burns,** Assistant to the Vice President, has been elevated to Vice President.

A native of Butte, Mont., Mr. Corette was educated at Montana State University and the University of Virginia, where he received his LL.B. in 1930. He was associated with the law firms of Murphy & Whitlock and Corette & Corette, practicing in Missoula and Butte, before becoming general counsel for Montana Power in 1934. Ten years later he was named vice president and assistant general manager and, in 1948, a director.

A member of the Montana Bar Association and the American Bar Association, Mr. Corette is Vice President and Managing Director of the Canadian-Montana Pipeline Co. and Canadian-Montana Gas Co., Montana Power subsidiaries. He is also a director and member of the National Association of Electric Companies.

Mr. Burns joined the company in 1920 as a clerk in the service department and, after becoming, successively, manager of the Bozeman and Butte Divisions, was appointed assistant to the vice president in 1951.

A veteran of more than 40 years of service with the electric industry in Montana, Mr. Bird has been associated with Montana Power since its formation in 1912. He became vice president and a director in 1935 and was named president and general manager in 1940.

Charles E. Ide, President of the Toledo Edison Co., has been elected President of the Ohio Electric Utility Institute, succeeding **Harold Turner,** Vice President and General Manager of the Ohio Power Co.

James M. Stuart, Vice President and General Manager of The Dayton Power & Light Co., was elected Vice President. **H. C. Vincent,** Treasurer of the Columbus & Southern Ohio Electric Co., and **J. B. Johnson,** former Vice President of the Ohio Public Service Co., were re-elected Treasurer and Manager - Secretary, respectively.

MR. CORETTE

The Ohio Institute played host to the 20th Annual EEI Convention last June 2-4 in Cleveland.

Elmer Lindseth, President of The Cleveland Electric Illuminating Co., was elected to the Board of Directors of the American Management Association at the association's annual meeting held recently in New York City. Mr. Lindseth will serve for a term ending in 1955.

Dunlap D. Smalley, Vice President in Charge of Operations, Pacific Gas and Electric Co., has been elected President of the Pacific Coast Electrical Association, succeeding **Emery D. Sherwin,** Vice President in Charge of Operations, San Diego Gas & Electric Co. Mr. Smalley, who has been active in the utility industry since his graduation from University of California in 1910, was elected to the presidency at the association's annual convention held recently in Coronado, Calif.

Charles R. Landrigan, Comptroller of The Detroit Edison Co., has been elected President of the Michigan Electric Association, and **J. H. Campbell,** Vice President of Consumers Power Co., has been named a Vice President of the Michigan group. Mr. Landrigan, who has been with Detroit Edison since 1912, was appointed to his present post in 1949.

Kenneth C. Lasseter, General Superintendent of Savannah Electric & Power Co., has been elected Vice President in Charge of Operations.

Except for the years between 1930 and 1937 when he was associated with the Western Public Service Co. in Nebraska, Mr. Lasseter has been with the Savannah company since 1923. Starting as a junior engineer, he was advanced to superintendent of transmission and distribution and to general superintendent in 1950.

Les M. Taylor, Vice President and General Sales Manager, Mississippi Power & Light Co., has, in addition to his present duties, assumed the responsibility of directing expansion of the company's Agricultural and Industrial Development Department and a newly created Public Information and Advertising Department.

L. O. Bradshaw has been named Manager of the development department, and **Herbert Shaddix,** Manager of the new information and advertising department.

Orrie Van Rye, Assistant to the President of the Worcester County Electric Co., has been named Assistant Vice President.

A native of Brielle, Netherlands, Mr. Van Rye began his utility career as a training student with Electric Bond and Share and later became assistant superintendent of distribution in Santiago, Cuba. He served next with Florida Power and Light, joining the New England Power Service Co. in 1929, where he was employed in various engineering capacities. In 1943 he was named director of labor relations for the New England Electric System, parent company of New England Power Service, rising to personnel administration counsel in 1946. In March, 1952, he transferred to Worcester County Electric, another NEES subsidiary, as assistant to the president.

Robert J. Kelly has been named Treasurer of the Central Illinois Light Co., succeeding the late **T. V. Griffith,** and **John Miller** has been appointed Assistant Secretary.

Robert H. Busler, Kansas City Power & Light Co., has been named Assistant Secretary, and **Clark B. Rosser** will be Assistant Treasurer.

A graduate of the University of Kansas and the University of Michigan School of Law, Mr. Busler practiced law before joining KCP&L in 1949 as assistant to the secretary. Mr. Rosser, who has also been with the company since 1949, is a graduate of the University of Missouri and served as an internal revenue agent of the U. S. Treasury before becoming associated with KCP&L as assistant to the treasurer.

D. D. Clarke, widely known in electrical engineering circles, has retired as a consulting engineer for Kansas City Power & Light, after more than 40 years' service with the company. He was graduated from the University of Michigan in 1910 and was an engineer for Westinghouse when he joined KCP&L in 1911.

Dennis H. Lane, associated with Stone & Webster Service Corp. for the past four years, has returned to El Paso Electric Co. as Assistant Treasurer. Mr. Lane first joined El Paso Electric in 1928.

C. Harry Anderson, General Superintendent of Operations, Western Division, Niagara Mohawk Power Corp., has been named Operating Superintendent of the Western Division, succeeding **Harold R. Waldron,** Operating Vice President, who recently retired.

A graduate of the University of Cincinnati, Mr. Anderson has been associated with Niagara Mohawk for 27 years. He is a member of the American Institute of Electrical Engineers, National Society of Professional Engineers, and EEI Transmission and Distribution Committee.

Richard M. Shepard, Assistant General Superintendent of Operations of the Niagara Mohawk Power Corp. for the last two years, has been named Assistant Operating Superintendent of the Western Division.

Dr. Huet Massue, Engineer-Economist of The Shawinigan Water and Power Co. and a director of Atomic Energy of Canada Ltd., has been appointed Manager of Shawinigan's newly established Economics and Statistics Department. Educated at the Ecole Polytechnique and the Massachusetts Institute of Technology, Dr. Massue has been on the Shawinigan company staff 25 years.

E. H. Peck, who joined Shawinigan upon receiving his engineering degree from McGill in 1936, has been named Assistant Manager of the new department. After spending several years in the company's offices at Three Rivers, he was transferred, in 1942, to the water resources department in Montreal, where he has been engaged in special studies.

Robert H. Engels, Northern States Power Co., has been named Manager of the Sioux Falls Division, succeeding **A. G. Buchholz,** who has retired after 45 years with the company.

Mr. Engels joined the company in 1926 as a merchandise salesman. In 1934 he became division sales manager at Platteville, Wis., and following three years in private business, he rejoined NSP in 1948 in the municipal sales department.

Vernon B. Bail, Manager of Monongahela Power Co.'s Fairmont Division, has been named Manager of the Panhandle Division, succeeding Robert H. Pell (BULLETIN, August, page 228). **W. Carlisle Wade,** Commercial Promotion Manager, succeeds Mr. Bail.

With the company since 1931, Mr. Bail was assigned to the Fairmont post in 1951. Mr. Wade, who joined Monongahela Power in 1930, has been serving as commercial promotion manager since 1947.

John S. Bennett, Local Manager of the Hornell District, New York State Electric & Gas Co., has been appointed Manager of the Perry-Hornell District, succeeding **Gordon Meyer,** who has retired after 38 years with the company and nearly 50 years in the utility field.

Joining the company in 1920, Mr.

Production for Freedom Week

(*Continued from page* 308)

companies, Pennsylvania Power & Light proposes to begin its celebration with a proclamation, signed by local officials and industry leaders, which will receive publicity in local papers. This will be followed by news articles, general newspaper advertising, possibly a newspaper supplement, and a power-for-production tabloid for distribution to schools, libraries, and business groups. Inexpensive banners and posters will be utilized in windows, on bulletin boards, or wherever public posting is possible, and PP&L's billboard advertising in industrial areas will feature the power-for-production theme. The company is also contemplating an essay contest for school children in order to stimulate greater public interest in the project.

In addition to preparing a production-for-freedom booklet, the Central Hudson Electric and Gas Corp. is promoting observances through cooperation with Chambers of Commerce in every community within the company's service area. Similarly, the Ohio Edison Co. has sent a "plan of action" for conducting such observances to all the Chambers of Commerce in its territory.

The Connecticut Light & Power Co. has informed 225,000 customers of the production-for-freedom activity by means of bill inserts and is planning a state-wide celebration under the auspices of the Manufacturers Association of Connecticut. The company is sponsoring window displays in 22 stores, conducting an advertising campaign in 40 newspapers, and tying in the production-for-freedom theme with a traveling exhibit, "Industrial Progress, USA." This same theme will be employed by the Utah State Fair and Industrial Exposition in September and by the Utah Power & Light Co. in magazine, radio, and TV promotions.

Preparations for Production for Freedom Week have been coordinated by a PIP Committee under the chairmanship of A. C. Spurr, President of the Monongahela Power Co. Alexander M. Beebee, President of Rochester Gas & Electric Corp., served as chairman in the closing weeks, while Mr. Spurr was on vacation.

Bennett became superintendent of the Hornell district in 1927 and manager in 1938. Mr. Meyer began his utility career with the Saugerties Gas Light Co. in 1902 and in 1914 was named manager of the Seneca Falls-Waterloo district of New York State Electric & Gas. Following a series of promotions, he was made manager of the newly formed Perry-Hornell District in 1938.

C. E. Filbin, Pacific Power & Light Co., has been appointed District Sales Supervisor of the Dallas District, succeeding **William K. Thomas,** who has resigned in order to enter religious work. With the company since 1947, Mr. Filbin has been a member of the district sales staff since that time.

Donald S. Bennett has been appointed Power Sales Manager for Worcester County Electric, succeeding **Fred E. Littlefield,** who has been transferred to NEES headquarters in Boston as power sales engineer. Mr. Bennett, previously engaged in power sales activities in the Mystic Valley area, has been replaced in his former position by **Warren K. Lewellen.**

John R. Ridgeway, Houston Power & Lighting Co., has been named Chief of the Major Equipment Scheduling Branch of the Defense Electric Power Administration, and **Henry Hansjergen,** The Cincinnati Gas & Electric Co., is new Chief of the Minor Requirements Branch.

CONVENTIONS AND MEETINGS

1952

SEPTEMBER

3-13	American Society of Civil Engineers, Centennial Celebration, Chicago, Ill.
5- 6	Maryland Utilities Association, Cavalier Hotel, Virginia Beach, Va.
7-10	Rocky Mountain Electrical League Fall Convention, Colorado Hotel, Glenwood Springs, Colo.
8	EEI Residential Section Chairmen Meeting, Cleveland, Ohio.
8	EEI Special Service Section Chairmen, Hershey, Pa.
8- 9	EEI Market Development and Electrical Applications Committee, EEI Headquarters, New York, N. Y.
8-11	ASME Fall Meeting, Sheraton Hotel, Chicago, Ill.
8-12	Illuminating Engineering Society National Technical Conference, Edgewater Beach Hotel, Chicago, Ill.
9-11	Area Development Institute, Silliman College, Yale University, New Haven, Conn.
10	EEI Commercial Sales Section Chairmen, EEI Headquarters, New York, N. Y.
11-12	EEI Commercial Cooking Committee, EEI Headquarters, New York, N. Y.
12	EEI Industrial Relations Committee, in conjunction with New England Personnel Group, Berlin, Conn.
15-16	EEI Accident Prevention Committee, Sheraton Hotel, Rochester, N. Y.
15-16	EEI Accounting Division Organization Meeting, General Activities Group, Netherlands Plaza Hotel, Cincinnati, Ohio.
17	PIP Steering Committee Meeting, Chicago, Ill.
17-18	EEI Accounting Division Organization Meeting, Customer Activities Group, Netherlands Plaza Hotel, Cincinnati, Ohio.
18-19	PIP Annual Workshop Conference, Edgewater Beach Hotel, Chicago, Ill.
19	Oklahoma Utilities Association, Gas Division Meeting, Biltmore Hotel, Oklahoma City, Okla.
19	PIP East North Central Regional Meeting, Chicago, Ill.
19-20	Public Utilities Association of the Virginias, Greenbrier Hotel, White Sulphur Springs, West Va.
22-23	EEI Wiring and Specifications Committee, EEI Headquarters, New York, N. Y.
25-26	Southeastern Electric Exchange, Engineering and Operation Section, Biltmore Hotel, Atlanta, Ga.
29-30	Missouri Valley Electric Association Accounting Conference, President Hotel, Kansas City, Mo.

OCTOBER

1- 2	EEI Industrial Power and Heating Section, New York, N. Y.
1- 3	Wisconsin Utilities Association Convention of Technical and Sales Sections, Schroeder Hotel, Milwaukee, Wis.

1952

OCTOBER

2- 3	PEA Electrical Equipment Committee, Irem Temple Country Club, Dallas, Pa.
2- 3	EEI Merchandising Committee, New York, N. Y.
2- 3	EEI Dealer Coordination Committee Workshop, Statler Hotel, Boston, Mass.
5- 8	Controllers Institute of America, Annual Meeting, Hotels Sheraton, Cadillac and Statler, Detroit, Mich.
6- 7	EEI Prime Movers Committee, Roosevelt Hotel, New Orleans, La.
6- 8	EEI-AEIC Joint Meeting, Meter and Service Committees, Mayflower Hotel, Washington, D. C.
8-10	Indiana Electric Association, French Lick Springs Hotel, French Lick, Ind.
13-14	EEI Electrical Equipment Committee, Roosevelt Hotel, New York, N. Y.
13-17	AIEE Fall General Meeting, New Orleans, La.
16-17	Southeastern Electrical Exchange, Accounting Conference, Jung Hotel, New Orleans, La.
17	EEI Commercial Division General Committee, Hotel Biltmore, New York, N. Y.
20-21	National Farm Electrification Conference, Hotel Statler, Detroit, Mich.
22	Oklahoma Utilities Association, Electric Light and Power Division, Western District, Lawton, Okla.
23-24	EEI Transmission and Distribution Committee, Hotel Adolphus, Dallas, Tex.
24	Oklahoma Utilities Association, Electric Light and Power Division, Eastern District, Shawnee, Okla.
27-30	AGA Annual Convention, Atlantic City, N. J.
28-30	AIEE Middle Eastern District Meeting, Commodore Perry Hotel, Toledo, Ohio.
29	PIP Southeast Regional Meeting, Birmingham, Ala.
29-31	Southeastern Electric Exchange, General Sales Conference, Thomas Jefferson Hotel, Birmingham, Ala.
30-31	PEA Fall Meeting, Prime Movers Committee, Hotel Roosevelt, Pittsburgh, Pa.
30-31	EEI-AGA Taxation Committee, Closed Meeting, Chalfonte Haddon Hall, Atlantic City, N. J.

NOVEMBER

10-13	NEMA Annual Meeting, Haddon Hall Hotel, Atlantic City, N. J.
10-13	NARUC Annual Meeting, Hotel Marion, Little Rock, Ark.
13-14	PEA Fall Meeting, Relay Committee, Robert Treat Hotel, Newark, N. J.
17-19	EEI Industrial Relations Committee, Annual Fall Round Table Conference, Sheraton Hotel, St. Louis, Mo.

DECEMBER

18	EEI Industrial Relations Committee, EEI Headquarters, New York, N. Y.

EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

OFFICERS

B. L. ENGLAND, *President*.....Atlantic City Electric Co., Atlantic City, N. J.
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H. S. BENNION, *Vice President and Managing Director*....420 Lexington Avenue, New York, N. Y.
H. S. SUTTON, *Treasurer*.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
A. B. MORGAN, *Secretary and Assistant Managing Director* .420 Lexington Avenue, New York, N. Y.

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(Terms Expiring 1953)

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(Terms Expiring 1954)

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L. M. SMITH.....Alabama Power Co., Birmingham, Ala.
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(Terms Expiring 1955)

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G. M. GADSBY.....Utah Power & Light Co., Salt Lake City, Utah
A. H. KEHOE.....Consolidated Edison Co. of New York, Inc., New York, N. Y.
ALLEN S. KING.....Northern States Power Co., Minneapolis, Minn.
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EDISON ELECTRIC INSTITUTE OFFICERS AND COMMITTEES

(Continued)

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Prime Movers, G. V. WILLIAMSON.....Union Electric Co. of Missouri, St. Louis, Mo.
Transmission and Distribution, J. A. PULSFORD.....Public Service Electric and Gas Co., Newark, N. J.

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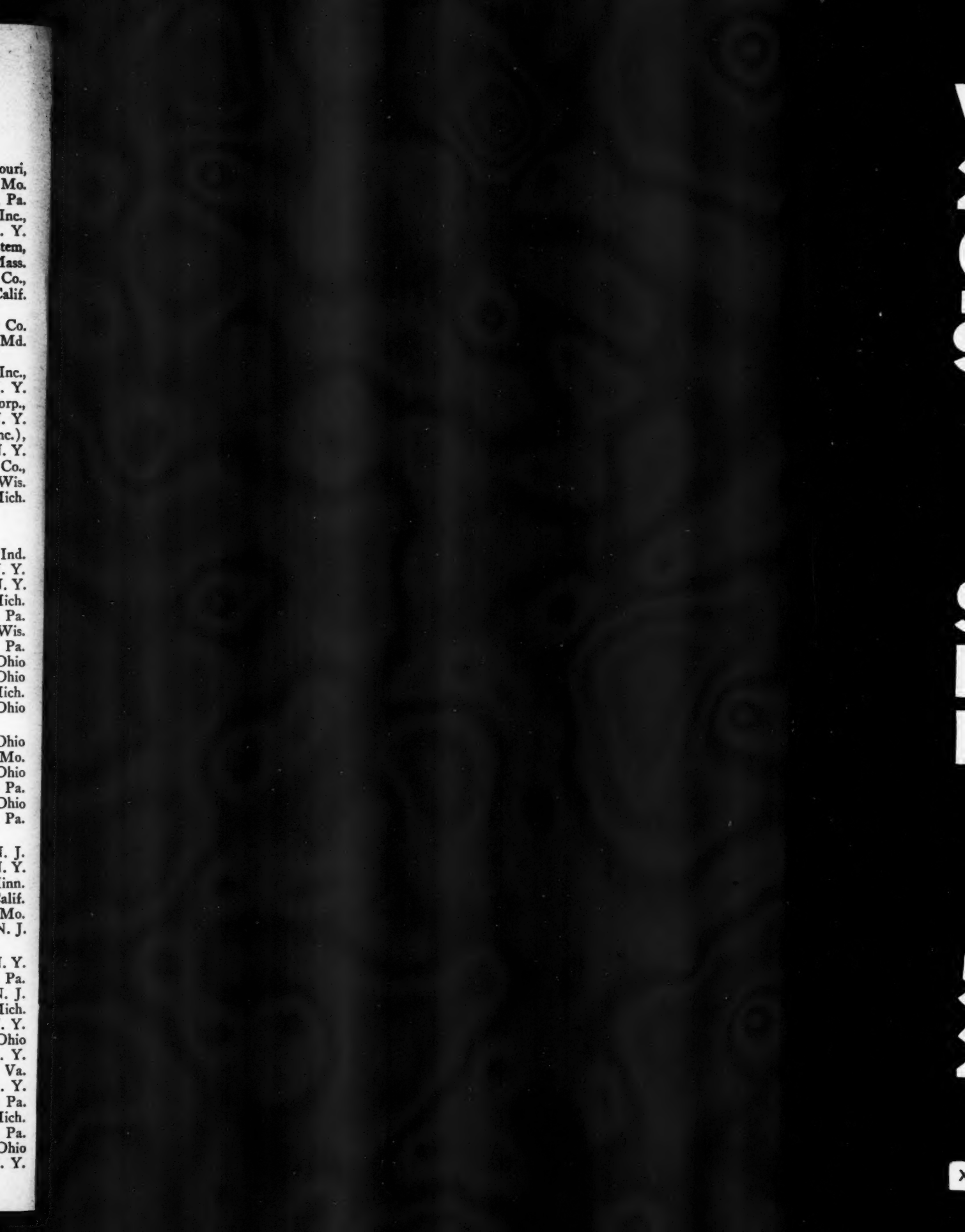
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